



Handish. J. O'grady

THE
FORESTER'S GUIDE
AND
PROFITABLE PLANTER.

EDINBURGH: PRINTED BY R. & J. B. & CO.

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PROFITABLE PLANTER

EDINBURGH: PRINTED BY A. BALFOUR AND CO.

THE
FORESTER'S GUIDE
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PROFITABLE PLANTER:

CONTAINING
A PRACTICAL TREATISE ON PLANTING
MOSS, ROCKY, WASTE, AND OTHER LANDS;
ALSO
A NEW, EASY, AND SAFE PLAN OF
TRANSPLANTING LARGE TREES,
AND
OF VALUING GROWING WOOD AND TREES OF ALL
DESCRIPTIONS.
TO WHICH IS ADDED,
THE PREVENTION AND CURE OF DRY ROT.

BY ROBERT MONTEATH
OF STIRLING.

SECOND EDITION,
WITH IMPORTANT ADDITIONS AND IMPROVEMENTS.

ILLUSTRATED BY ENGRAVINGS.

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PUBLISHED BY STIRLING AND KENNEY, EDINBURGH;
LONGMAN, HURST, REES, ORME, BROWN, AND GREEN, LONDON;
AND JOHN CUMMING, DUBLIN.

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TO

HIS MOST GRACIOUS MAJESTY,

GEORGE IV.

KING OF GREAT BRITAIN AND IRELAND,

THE MUNIFICENT AND ENLIGHTENED PATRON OF ARTS,

SCIENCES, AGRICULTURE, AND COMMERCE,

THE FOLLOWING TREATISE,

ON THE CULTURE AND MANAGEMENT OF FOREST TREES AND
PLANTATIONS,

IS, BY PERMISSION, RESPECTFULLY DEDICATED,

BY HIS MAJESTY'S

MOST HUMBLE AND DEVOTED SUBJECT AND SERVANT,

ROBERT MONTEATH.

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THE flattering approbation bestowed on the First Edition of **THE FORESTER'S GUIDE**, by the principal Landholders in the United Kingdom, encouraged the Author to proceed with confidence and alacrity to prepare a Second Edition. The opportunity for a revision has enabled him to acquit himself, in some measure, to the Public, for the high patronage he has

obtained, by corresponding efforts, to render this edition more useful and interesting to Proprietors, as well as practical Dealers engaged in the culture and management of trees and plantations. Besides additional information on other subjects, the present edition contains an entirely new Treatise on the Diseases of Trees—on the Rise and Progress of Dry Rot, with Instructions for completely preventing it in the Timber of Houses and Ships—a Treatise on Planting chiefly confined to Forests intended solely for Profit, with the different kinds of Trees to suit Situation and Soil—the surest and speediest Me-

thod of rearing Oak Trees for the British Navy, or making them grow crooked for all kinds of Ships—and some interesting Particulars connected with the Growth and Value, &c. of Trees and Woods throughout Scotland, the result of many years practical experience.

STIRLING, *June* 1, 1824.

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INTRODUCTION.

THE object which the Author of the first edition of the Forester's Guide had more immediately in view, in submitting its pages to the public, was to lay down rules, and to describe a method by which standing trees of all sizes may be accurately and expeditiously measured, and their exact value ascertained. Considering it also of great importance, in connexion with the subject, and as a thing entirely new and much wanted, to state the method of valuing oak coppice-woods of all ages, he commenced the work with a few observations on the pruning, thinning,

and training up of coppice-wood ; to which was also added, the most general, as well as the best mode of cutting, dressing, and rearing up of natural oak woods : a thing also new and much wanted. The general approbation that this little work met with from the public, was a strong incitement to publish a second edition : and having obtained more extensive knowledge and experience of the subject, the author was induced to add a section on planting, in which will be found many things useful and new. In this, as in the first edition, the author is guided more by his own experience than by theory, or by those who have trod the ground before him. Till after publishing the first edition, he had never read a single author on the subject. Where one or two are quoted, these were sent him by a friend. Since the first edition was published, he has consulted different authors, but must confess himself more bewildered than instructed ;

and considering the extensive variety of his own experience, which he is enabled to lay before the public, in order to be as concise as possible, very few quotations will suffice. In the sequel, the author trusts it will be found that he has aimed more at being intelligible than elegant, more at being concise than verbose, which would only obscure his meaning. He makes no pretensions to literary knowledge—he advances what he conceives or knows to be facts—he is not guided in his opinions by theory, but proposes and recommends what is the result of many years experience.

He cannot forbear mentioning, that the planting and training up of woods to maturity in Scotland, particularly in many counties of it, where there are many thousands of acres capable of bearing most excellent timber, and suited to no other purpose, is an art as yet only in its infancy. He trusts,

should these pages ever fall into the hands of those noblemen and gentlemen of his native country, who have land of the above description, and if they should chance to peruse it, after seeing, from the true statements which experience has enabled him to submit, the value of an acre of oak wood land properly trained up, that they will not consider such plantations merely as they may ornament and beautify their estates, but as the means also of immense revenue.

The cultivation of timber for the construction of ships, to enable this our sea-girt island to repel the invasion of foreign enemies, and maintain its dignified naval pre-eminence, is an object of the very last and greatest importance to Britain, which is every day more and more depending upon her navy for her salvation. He would recommend to those who are inclined to consider the rearing of oak plantations in the light of

a national benefit, the perusal of the letter of the late Lord Melville to the late Mr. Percival, upon the subject of naval timber, published in July 1810. Coming from the pen of a writer so able, a statesman so profound, dictated by a judgment so correct, and a knowledge of the subject so extensive, it cannot fail to show that it is, and always will be, the soundest policy, to have as abundant a supply as possible of native British oak woods.

If the following document regarding the government forests in Essex be not long ago remedied, it is ground of grievous lamentation and shameful neglect. "On a survey of the timber in the king's woods in Essex," says Mr. Young, "it was found that the whole number of oak trees, from ten feet upwards, was 11,055. Of these, 2760 were reported to be trees of thirty feet and upwards, and to be fit for the use of the navy ; 7825 were young

trees, from thirty feet down to ten feet each, and the rest scrubbed and unthrifty. On the whole, the number of oaks was less than four trees to the acre; and of those thirty feet and upwards, less than one tree to the acre*. What a dreadful deficiency of a crop! This land, capable of carrying fifty trees on the acre to 100 years old, which should be worth at least L.20 per tree—say L.1000 per acre, according to the above statement is not worth L.10. We hope, however, that the crown forests are now much better attended to; although it appears, from a publication so late as 1820, they are not in the state of improvement that they should be. The alarming decrease of oak timber in this country is universally acknowledged and lamented; and it has become an important desideratum to every man who wishes for the preservation and

* See Young's Agriculture of Essex, and Annual Review.

independence of his country, that some active and efficient legislative measure should be immediately adopted, to avert the impending evil that must inevitably take place. It is said that Britain is going to build ships of war of mahogany; but those who are acquainted with the nature of mahogany, will tremble for the safety of our gallant seamen, when they are necessitated to face the enemy in mahogany ships, when the splinters from one shot will kill more men than ten bullets. But granting there was not such great need, as we have been arguing, for timber for the navy, might not these forests be turned to great advantage, and bring in a very great revenue, by supplying the country demand? as it will be clearly shown in the following pages of this work, that land not fit for carrying any other kind of crop, can, by proper attention and management, pay at the rate of five pounds Sterling per acre, of annual

rent, counting interest and compound interest, &c. But, to carry the matter a little farther, were our foreign supplies of timber cut off by a war for ten years only, the whole country would not afford a five years supply of full-grown timber ; and, if my information be correct, there is not as much full-grown timber at present, in all the national forests, (from their neglected state,) as would replace, or fit out a navy as it stood in 1810. In the present state of agricultural distress, were government to adopt the following plan, it would not only enrich, and make up their exhausted funds, but keep the nation always independent, beautify the country, enrich the exhausted landholders, completely relieve the distressed agriculturist, and give employment to thousands of half-starving labourers. Supposing the government to become feuars or tenants to a number of the landholders in Scotland, England, and Ireland, particularly

to those whose lands hold a local situation to the sea ; suppose, in Scotland, Argyle, Ross, Inverness, Aberdeen, and Forfarshire ; in most of which there are a great number of acres that would carry fine timber to maturity, and which are fit for nothing else, that could be got for ten shillings per acre, which, if planted and converted into forests, would, with proper management, even during their minority, pay the expense of annual rent by their thinnings ; and, by laying a high duty on the importation of foreign barks, these forests, at twenty-four years old, and for ever after, will bring in a clear annual profit of at least four pounds Sterling per acre, even in times of profound peace ; besides the great advantage of keeping always an abundant supply of naval oak timber. France has, in her public forests, a source of revenue which is altogether unknown in this country. Under the old go-

vernment, these forests covered three millions of acres, and yielded annually a produce of half a million Sterling—wood being the principal fuel ; but since the revolution, the annexation of emigrant, and other property, has increased their extent to five millions of acres, and their revenue to nearly three millions Sterling per annum. Above eight thousand persons are employed in taking charge of these forests, and nearly four times that number are working constantly in them ; by which means the French government has always a supply of timber.

In the shires of Aberdeen, Forfar, Inverness, Ross, and Argyle, there are vast tracts of land well calculated for the purpose of rearing timber, situations rendered still more eligible by their local advantage of easy sea carriage, as already alluded to. These considerations should hold out inducements to the landholders of these extensive districts,

to plant infinitely more than, for several years, they have been in the habit of doing, more especially, when connected with this consideration, that they would yield a vast deal more when laid out in timber, than if they had been laid out for any other purposes of agriculture.

The objection urged against planting is, that the present proprietor or planter will derive no benefit from his labour and expense, that the profits are distant, that this holds out no inducement to speculators : but in the sequel it will be seen that the planter will obtain very considerable advantage from so doing. But, granting that the planter does not derive any personal benefit immediately from the woods, the estate is by so much the more valuable, in proportion to the quantity planted. To confute the old, as well as new, argument, of profits from planting being so distant as to hold out no encouragement to

individual proprietors to plant, take the following statement of facts, (besides what will be found in the sequel,) taken from actual measurement. There is at present, on the estate of Inverary, the property of the Duke of Argyle, a plantation of larch firs only sixteen years old, bearing 1000 trees on each acre; every tree is well worth, and would sell, at the present time, (taking into consideration the reduced price of timber,) at four shillings, being L.200 Sterling the acre, which, after deducting the expense of planting, and allowing a fair rent for the land, with interest and compound interest, will yield at least L.8 an acre of annual rent; the thinnings having paid more than the expenses of fencing the plantations, &c. Here we have a return, and an amazing profit, in sixteen years. There is, on the same estate, a silver fir tree, seventy years old this spring, girthing ten feet, containing upwards of 300 solid feet;

there are hundreds of trees the same age, and nearly the same size, on the same estate. An acre of land will easily carry sixty such trees; which, at the low price of two shillings per foot, will amount to L.1800 an acre. There is also, on the estate of Airthrey, in Stirlingshire, the property of Sir Robert Abercromby, a plantation of ash trees, only fifty-nine years old, averaging 600 trees on an acre, and many of these trees have upwards of sixty feet of a bole without either knot or branch, girthing four feet, the average solid measure of the whole being thirty-two feet each tree; which, at two and sixpence per foot, (a low price for such trees,) is L.4 per tree, being no less than L.2400 per acre; and he is well informed that the thinnings of these ash trees have paid a fair rent for the land ever since they were fifteen years old. These trees underwent a slender

thinning two years ago, but can still be seen on the estates. What an immense sum for the crop of one acre! Who will dare to affirm that plantations are not worth care or attention in rearing, even laying ornament and shelter aside?

As to the quickness of rearing plantations, take the following example, amongst many that could be given, which can be well attested: There was a general thinning of the plantations referred to on the estate of Airthrey in spring, 1822, and from the manner in which the stools of the oak, ash, elm, plane, and Spanish chesnut were dressed up, they sent out young shoots with such rapidity, that thousands of them measured, in the month of September, after being cut, only about five months growth, six, seven, and eight feet, and some particular shoots ten feet long; and many of them girthed three

inches at the root. This, of course, must be the surest, speediest, and most effectual method of rearing plantations ; but more of this under the section Coppice Woods, cut every twenty or twenty-four years.

On mentioning the growths of the ash trees, &c. to a gentleman, he sent me the following table of the increase of the growth of twelve trees, which confirms my statement, although nothing of the kind is necessary, as the trees are still upon the ground, and can be seen, but he considers it well worth a place here.

From this table, it appears that twelve trees have increased three hundred and fifty-three cubic feet in sixteen years, which, if sold at the low price of one shilling per cubic foot, would amount to L.17, 13s. Sterling. Now, if we should suppose a Scotch acre of ground planted with a tree, thriving at the same rate, at ten feet distance from one another, it would contain upwards of 540 trees, and would, of course, yield an increase of 15,885 cubic feet in sixteen years, which, if sold at one shilling per foot, would amount to somewhat more than L.794 Sterling, which, divided by sixteen, gives L.49, 10s. for the annual produce of one acre.

As a still farther proof of this, the reader is furnished with the following

STATEMENT :

If the proprietor, for instance, plants 100 acres of ground, the trees being placed four feet distant from each other, each acre will contain 3422 plants ; if it is planted with hard woods,

chiefly oaks, and a few firs to nurse them up, supposing it is a plantation intended solely for profit, the expense of plants and planting per acre will be £6,			£600	0	0
Rent of land for 10 years, at £1 per acre, per annum *,	-	-	1000	0	0
Interest on the rent,	-	-	225	0	0
Expenses of thinning, pruning, and training up, for 10 years, at £1 per acre, per annum,			1000	0	0
Total expenditure,			£2825	0	0
Deduct produce of 1000 trees thinned from each acre during the first 10 years, at £2 per acre,	-	-	£200	0	0
Deduct value of 2422 trees left on the ground after the first 10 years, at £7, 10s. per acre,	-	750	0	0	
			950	0	0
Total outlay at the end of 10 years,	-		£1875	0	0
To which add expense of thinning and pruning for the next 10 years, at £2 per acre,	-	£200	0	0	
Rent of the land for the same period at £1 per acre, per annum,	1000	0	0		
Interest on the rent for the same period,	-	275	0	0	
Interest on £1875 for 10 years,		937	0	0	
			2412	10	0
Total outlay for 20 years,	-	-	£4287	10	0

* It will not be disputed that there are thousands of acres of land capable of bearing excellent timber, that are not worth 10s. per acre to the proprietors; and that, therefore, the rent of land is here perhaps exaggerated.

	Brought forward,	£4287 10 0
Deduct produce of 1000 trees thinned out during the last 10 years, from each acre, which will, at the least, bring 6d. each, or £25 per acre,	- - £2500 0 0	
Deduct for 1422 trees which fall to be enhanced in value during the last 10 years, and will come to, at least, £35, 11s. per acre,	3555 0 0	
		6055 0 0
		£1767 10 0
Deduct from this the value of these 1000 trees as they were estimated at the end of the first 10 years, at £3, 2s. per acre,	- - 310 0 0	
Thus leaving a balance in favour, of	-	£1457 10 0

We have now value on the ground of L.14, 10s. each acre, at the end of twenty years, which is L.1457, 10s. after allowing for every expense. We shall now extend the calculations to a further period.

Rent of other 10 years, at £1 per acre, per annum,	- £1000 0 0	
Interest on the rent,	- 275 0 0	
Expense of thinning out 500 trees, and pruning, &c. &c. at £3 per acre,	- - 300 0 0	
Carry forward,		£1575 0 0
C 2		

	Brought forward,	£1575	0	0
Value of 500 trees, which being now 30 years old, bring at least 3s. per tree, or £75 per acre,	£7500	0	0	
Interest on £2500, for 10 years,	1250	0	0	
		8750	0	0
		7175	0	0
Deduct from this the value of 500 trees per acre, as they were estimated at the end of 20 years, about £11, - - - -		1100	0	0
		6075	0	0
Add balance in favour at the end of 20 years,		1457	10	0
But there are still 922 trees on each acre, each of which is worth at least 3s. 6d. or £161, 7s. per acre, - - - -		£16,135	0	0
Total in favour at the end of 30 years, -		23,667	10	0

We shall now extend the calculation for ten years more.

Rent for other 10 years at £1 per acre, per annum,	-	£1000	0	0
Interest on the rent,	-	275	0	0
Expense of thinning out 422 trees per acre, at £4 per acre,	-	400	0	0
Carry forward,		£1675	0	0

Brought forward,	£1675	0	0
But there being still too many trees on the ground to be nursed up to maturity, suppose, therefore, that 422 trees are thinned out from each acre, the value of each will be at least, when they have now attained the age of 40 years, 4s. 6d. each, or £94, 19s. per acre,	£9495	0	0
Interest on £7500, and on £2500, for ten years,	5000	0	0
		14,495	0 0

But deduct the value of 422 trees, at the rate at which they were estimated, at the end of 30 years —3s. 6d. each,	7385	0	0
		7110	0 0
			5435 0 0

Add balance in favour, at the end of 30 years, £23,667 10 0

There are still 500 trees on each acre, each of which is now worth at least 5s. or £125 per acre,	12,500	0	0
		£41592	10 0

Suppose an expense is incurred in incidental expenses, such as sale, &c. of *	592	10	0

* It will be seen by any unprejudiced person, that I have estimated the expenditure at more than what will do it at the present day.

Were I to live for 40 years longer, I would undertake, with

A balance is left in favour of the proprietor at the				
end of 40 years, of	-	-	-	£41,000 0 0

Thus the value of the wood on each acre, the wood having attained the age of forty years, is L.410; supposing the whole were to be cut down even at this age, the profit would be immense. These calculations may, to those who have paid no attention to the subject, excite wonder if not doubt; but, in making them, the author has been careful, rather to lessen than to exaggerate the profits. It is surely no uncommon thing to see an oak tree at forty years of age worth 7s. 6d. but much oftener worth 15s.; and it is no uncommon thing to see a plantation at that age bearing more than 500 trees per acre, which is a distance of ten feet between each, worth that sum.

any gentleman, to rear up, and give him, on the ground of 100 acres of land where he is perhaps not receiving 10s. per acre, the full value here stated, without any additional charge of expenditure.

But if the plantation shall have been carried to the age of sixty or seventy years, and properly thinned, &c. the value will be double what it was at forty years. The author begs to be understood, that he does not mean the thinnings to be made only at the end of every ten years ;—this, besides the disadvantage of bringing too much wood into the market at once, ought to be done gradually and regularly. The manner of doing it is laid down in Section II. of this work. From the above calculations, it will be seen, that if an estate is to be left to the family of the proprietor, he benefits his posterity as much by planting 100 acres of wood, as by adding 500 acres of good land to the estate. And if the estate is to be sold, the value of the wood will enhance the value of the estate in proportion.

I have known proprietors to have received

the profits of three several cuttings of natural oak woods, when they have been cut every twenty-four years, or from twenty to thirty years, so that a young proprietor entering upon an estate at the age of twenty-one, and enjoying life to a tolerably old age, may derive great advantage from planting and training natural oak woods for coppices, or oak, or even any other wood, to maturity. Many other advantages might be enumerated as resulting from the planting and rearing of timber; but this subject has been treated of by persons far better fitted for the task.

The author has known many young plantations much hurt and destroyed by the change of managers or foresters. He has heard managers or foresters newly appointed, say, that unless they did something new, that is to say, something differing from their pre-

decessors, they would be little thought of, even though what they were doing, they were well aware, was decidedly detrimental to the interests of their employer, and diametrically opposite to their own better knowledge. If one particular rule, therefore, were laid down, it would prevent this ridiculous and injurious procedure, since the new manager would have no excuse for his innovations. It may be proper here to remark, that much of the success of a plantation must depend on the person to whom the management is entrusted. If the proprietor has neither time nor inclination to attend personally to his plantations, he ought to choose an experienced person to perform the duty ; and, if possible, a person that is settled near the planting or plantation, and one who, from age, &c. is likely to retain the situation for some time ; because, it is very obvious, that he who plants, ought, if possible, to nurse up the plantation,

since, if the plantation do not thrive, his own credit is at stake. On the contrary, the proprietor who is always, or frequently, changing his planter, forester, or manager of his plantation, must never expect to see his plantation prosper; for the credit of the new manager, &c. rises on the miscarriage of his predecessor; nay, he even conceives he has an interest in neglecting what the other has planted, since what he himself plants will be seen to more advantage. His predecessor, being aware that he should not remain sufficiently long in his employment to see his labours succeed, becomes careless and dispirited, since he wants the stimulus necessary to induce him to go on; in short, he feels he has no interest in bestowing any pains to put the plantation into a thriving condition. Such occurrences have, oftener than once, come within the observation and knowledge of the author.

It will perhaps be urged, that during a period of profound peace, there is little inducement for planting, or even for taking care of those plantations which are already on the ground, from the great depreciation in the value of timber, which is accounted for by the very extensive importation of that article from America, and the supply from that quarter being inexhaustible, the price will continue low, and hold out no inducement to the planter in this country. Oak wood, it will be said, is not now in demand, as ships of war are no longer required—this species of argument is almost too absurd to require to be controverted. We certainly do at present enjoy a state of peace; but who knows what to-morrow may bring forth? We do enjoy peace, but who shall dare to affirm how long we shall enjoy it? Other countries are by no means in a state of tranquillity; and the repose of our own has been threat-

ened. An American war has been, and may be still anticipated. A long state of peace, however, is a circumstance to which we have no right to look forward.

In the event of an American war, the supplies from that quarter will be in a great measure cut off; and, as timber does not resemble any other crop, sown in spring, and reaped in full maturity in autumn, a time of peace is fully as proper a season for planting as a time of war. The present holds out many advantages for planting, &c.; work is scarce, and labour is done at an easy rate.

It is in the power of the rich to do much good by employing the poor in such a manner as eventually to benefit themselves; and it is the wish of the individual who publishes this work, to point out the manner, in one instance, in which it may be done, with mutual advantage to the employed and the employer. It is with this view, more particularly, that

he calls upon the attention of the landholders, more especially of Scotland, to the further planting and improving their waste lands, because there are many thousands of acres in Scotland, that are calculated for rearing and bearing timber, and are of no use for the purposes of agriculture or pasture. The following pages, he trusts, will point out such advantages as will induce most, if not all, the landholders, to turn their most particular attention to a subject, which, if pursued, will be productive of the most essential results.

Though ship-building on behalf of the government is not now so extensively carried on as formerly, still the building of ships of war is carried to such an extent, even at the present moment, as would, in other countries, be considered enormous. Add to this, that Britain, the first commercial nation in the world, possesses more merchant ships than

almost all the other countries of Europe ; it must follow, that oak, even in times of the most profound peace, a period favourable to commerce, must meet with a ready market. British oak, more especially Scotch oak, must always be in demand, from the well-known fact, that a Scotch oak plank will last thrice as long as a plank of American oak.

It has been said by some, that there is no danger of timber becoming scarce in this country ; but if we consider the great quantity used in ship-building, we must hesitate to admit this assertion, and contend for the contrary ; namely, that there is every reason to suppose it will become scarce, more especially should the supply from America be cut off. This will be the more readily admitted, when we consider the enormous quantity of wood required to build a seventy-four gun ship.

Mr. Marshall, treating of wood lands, &c.

says, “ A seventy-four gun ship swallows up 3000 loads * of oak timber, which is no less than 150,000 cubic feet.” He also adds, “ It will, of course, take 2000 large well-grown timber trees, of two tons each ; supposing these trees to have stood at the distance of thirty-three feet from each other, the distance they should stand at in a plantation for such trees, each statute acre would contain forty trees, consequently the building of one seventy-four gun ship would clear, of such woodlands, the timber of 50 acres.” This quantity is certainly very great ; and, of course, an equal proportion will be required, according to the size, from a cutter to a three-decker.

Supposing all the waste lands in Scotland (which, by the Report of a Committee of the

* A load of round timber is forty feet, and of square timber fifty feet ; which forty feet of round or rough timber are reckoned a ton, and fifty of square timber a ton.

Board of Agriculture, amount to no less than 14,218,224 acres) to be covered with full-grown oak timber, it would prove very inadequate to replace the British navy and merchantmen as they stood during the last war with France. It must thus be apparent that it is absurd to say there is no use in planting, and that there never can be a scarcity of timber fit for ship-building.

But let us consider the annual consumption of timber used for the British navy and merchant ships alone, which from good authority is not less than 9,963,480 cubic feet ; add to this the vast quantity used for house-building, machinery, and agricultural purposes, which will not be less than four times that quantity. Any one who considers for a moment, that nearly the whole of that enormous quantity is imported annually from foreign parts into England, Scotland, and Ireland ;

and were these foreign supplies to be cut off, I could aver that, before twelve months, we would, to our sad experience as a nation, see a scarcity of timber. From the returns of the King's forests, it appears that, through mismanagement and inadequate regulations, they do not, on an average, furnish above one-fortieth part of the oak timber required annually for the navy and commercial purposes of Great Britain *. Another argument that weighs heavily against planting, particularly with proprietors who are considerably advanced in life, is, that they will not live to see them become ornamental to their estates, far less to reap any profit from them. This is all very true; but does the present generation owe posterity nothing? Is the present proprietor justified in scourging the estate, by cutting and not planting,

* See Abstract on Woods and Plantations, by the Rev. Mr. Hamilton, minister of Ashkirk.

in the same manner as a tenant would do who is left to the freedom of his own will, and who, towards the end of his lease, scourges and scourges the ground, till he leaves his whole farm not worth one shilling per acre? We certainly owe our posterity much as well as our country; and the proprietor who plants the waste lands on his estate, serves his posterity more, besides beautifying the country, than the proprietor who adds as many acres of land to his estate by purchase,—as has been already shown.

But the most difficult of all objections to planting in some, and, indeed, in too many cases, is still to be overcome; that is, on entailed estates. Have we not often seen trees, that have been the work of ages in rearing, cut down without the least regret, and the respectable look of the estate at once disfigured and disgraced? As to the merits or demerits of entails I have nothing to do; but

would it not be advisable for the present proprietor of an entailed estate, to consult with the apparent heir of entail, and let him pay at a fair valuation for whatever is planted for the improvement of the estate, as also for some of the old timber to remain on the estate, rather than allow it to be cut down; and thus keep up the respectable look of the place? But, besides all that we have said, groves, belts, and plantations on an estate, emblazon the very name of the planter; and his name, long after he is no more, is mentioned with heartfelt gratitude and reverence, and that, too, by strangers passing by, who on beholding the sublime grandeur and majestic appearance of the noblest of all nature's productions, striking his eye with magnificent grandeur on the summit of a hill, long before he arrives at its base, and the valleys also covered with the monarchs of the forest, breaks out in ecstasy, and at once

pronounces the place a paradise *. But can strangers, as they pass, look into the desks of a proprietor, and admire his sums of

* The ancients describe heaven, or a state of future happiness, as being a place abounding with groves of beautiful trees, &c. And it is surely well worthy of notice, that the oak, one of the most ornamental trees in nature, should, at the same time, be the most useful to mankind. Its leaves are of use; the husbandman is well acquainted with the value of its acorns; every man, as well as the tanner, experiences daily the useful effects of its bark; and the value of its timber is known to the whole world. Was it not the oak, bearing British valour, and navigated by British skill, that raised us, at once, to the summit of national glory? And ought we not to keep it in remembrance, that our existence as a nation depends upon the oak? If therefore our forefathers, merely from the magnitude and majesty of its appearance, the veneration due to its age, and gratitude, perhaps, for some few economical uses they might apply it to, paid divine honours to this tree, how much more does it become every landholder, circumstanced as we are, to plant every acre of his waste lands. By this he will beautify his estate, enrich his family, and afford an ample and substantial material to rebuild the wooden walls of Great Britain. Under the shadow of these favourite trees, divine homage hath been often paid to our Creator, and upon its gun-worn boards the knees of British heroes have often bent, and with grateful hearts, offered up thanks for victory to the God of battle and Britain's salvation. Acts like this stamp the oak with that respectability and veneration which is due to it from every British subject.

“ This is the place, the centre of the grove :
Here stands the oak, the monarch of the wood.—
If ancestry can be in ought believ'd,
Descending spirits have convers'd with men,
And told the secrets of the world unknown.”

gold and silver, bills and mortgages, &c. ?
No, they cannot ; besides, these may only last
his successor a few years after he is gone ;
whereas his plantations will make his name
revered for ages ; and passers by, enraptured
with the delightful scene, will be ready to
pronounce the following lines :

“ Now, peace to his ashes who planted yon trees,
That welcome my wandering eye :
In lofty luxuriance they wave with the breeze,
And resemble a grove in the sky.
On the brow of the mountain, all barren and bleak,
They flourish in grandeur sublime,
Adorning its bold and majestic peak,
Like the lock on the forehead of time.

Then, peace to his ashes that planted yon trees ;
Supreme o'er the landscape they rise ;
With simple and lovely magnificence please
All bosoms, and ravish all eyes.
Nor marble, nor brass, could emblazon his fame
Like his own sylvan trophies, that wave
In graceful memorial, and whisper his name
To ages unborn, from his grave *.”

* Referring to the plantations on the estates of Airthry, Alva, Inverary, and Kinfauns, when seen from the rivers and level surrounding country, their magnificent and sublime grandeur surpasses all description.

I trust that I have sufficiently shown that the planting and rearing of timber is both a great national and individual benefit ; and there is no easier way of raising fortunes for younger children. It is so easy, and so certain of success, that it is a crime to neglect it ; and the nation, as well as families, suffers by the fault.

How common is it to see the trees about a gentleman's seat, or in a long avenue leading to it, which were planted only to please the eye, of such a value as warms the next heir's heart when he looks at or thinks of them. " Others might as well have been planted," says he, " in waste places as these for ornament ;" and he is ready to reflect on his parent for not doing it. But let him take care to do for his son what would have been so acceptable to himself. I have heard a most respectable and extensive landed proprietor in the Highlands of Scotland, yet in life, and

who made most expensive and extensive improvements on his estates, often say, that if he had planted wood, particularly oak, when he came to his estates and began his improvements, in place of improving for cropping, grazing, and rearing cattle, he would have had many thousands of pounds in his pocket at that time; although he only experienced the effects of it in one small instance, having, in 1822, sold a lot of wood, about L.2000 Sterling; and which, if it had been put together, would not have covered from twelve to fifteen acres of ground; and which was, on an average, under thirty years old, and grew on places that could neither be cropped nor pastured to pay any thing.

Having viewed the planting of trees as a great national and individual benefit, may we not contrive a method by which it may also become of the greatest benefit to the tenants of farms? As in the sequel it will be clearly

shown, that, of all agricultural pursuits, none is more profitable than planting and rearing trees, either for cropping or standing timber; and might not this easily be done by landlords, when they grant leases, by inserting a clause, obliging the tenant to plant a certain number of forest trees yearly during the currency of his lease, in such places as the landlord, or his steward, shall point out; and binding him to protect the same, and replace them when destroyed? As a stimulus, or encouragement, to engage the tenant's attention to the propagation of timber trees, and that he may have a beneficial interest in planting upon the land he occupies, at the expiration of the lease, the trees should be valued by two persons mutually chosen by landlord and tenant, and the landlord to pay his tenant such value as these valuers set upon the trees planted and reared up by the tenant during his lease; and,

in case of refusal, the tenant may sell and carry them away.

By this method of securing to the tenant a return of his capital, and the profits of it, many valuable grown clumps, belts, and strips of planting would be produced, which never would have existed otherwise. Besides the advantage of shelter, so essential to the grazing farmer in rearing cattle, every inch of his farm that he could not otherwise turn into any kind of crop, would be occupied with what would bring him money at the end of his lease; and the proprietor would have the advantage of obtaining a stock of timber at a fair value, which he could not have procured but by means of such a reasonable provision on behalf of his tenants, besides having on every one of his farms an abundant supply of timber for all kinds of husbandry purposes. As a proof

of the great benefits resulting to the tenants from such leases, take the following example.

The farm of Crosscapple, parish of Dunblane, and barony of Kinbuck, Perthshire, was taken by Mr. J. Dawson for two nineteen, say thirty-eight years, and entered to in 1777, or 1778, at the annual rent of L.26 Sterling. There was a clause in the lease, that Mr. Dawson, the tenant, should, if he had a mind, plant all the wet ground that he did not think proper to plough, with trees of any kind; and the tenant should be at liberty to use what of that wood he required, during the currency of his lease, for all the husbandry purposes on the said farm, as well as for all the houses he required, or saw meet to erect on said farm. At the end, or expiration of said lease, all the standing timber was to be valued by two persons, mutually chosen by landlord and tenant. And it was expressly stipulated, that if the two valua-

tors chosen did not agree, they were to choose a third person, and his opinion betwixt the arbiters was to be binding on both parties: And to their valuation the landlord was to pay the tenant in ready money. In February, 1817, the year after the lease expired, Mr. M'Arthur, forester in Drummond Castle, was chosen by and on the part of James Dawson, then the tenant, (and now living in Dunblane,) as his valuator; and I was appointed by the trustees for behoof of the heir of Kippenross estate, then a minor. We met on the ground, and each for himself valued the wood. After comparing our valuations, there was a difference of about L.25 Sterling. We then named Mr. William Stirling, architect, Dunblane, who divided the difference; and all parties having agreed, fixed the value of the wood on said farm at L.1029 Sterling; which sum was promptly paid by the trustees of the estate to the tenants. The whole rent of the

farm, paid annually for thirty-eight years, amounted to L.988. Sterling. The value paid by the proprietor for the wood was L.1029, being L.41 more than all the rents of the farm during the whole lease ; besides, after the first ten years, the tenant had a sufficiency of timber for all house and husbandry purposes during the remainder of his lease. Let it be here observed, that, in valuing the said wood, we proceeded on the data of its being all cut down at the time, and brought to market, which was twenty per cent. lower than the like timber was selling for a few years before that time.

The tenant being left to the freedom of his own will, as to the kind of trees to plant, he very injudiciously planted mostly Scotch firs ; whereas, had he planted oak and ash, the soil and situation being well adapted for these kinds, he would have had nearly three times that sum to receive. The wood being

young, and all very healthy and thriving, it must, of course, (as is allowed on all hands,) advance more in value in one year after that period, than it would do on an average in three years before it ; and, viewed and valued as trees thriving, and attached to such land, and affording shelter and ornament thereto, was, at that time, agreed on by all, as worth forty per cent more to the estate. In this case both the interest of the landlord and the tenant was combined, and both in a very great degree advanced.

If this, or a similar plan, were adopted by both landlord and tenant, and each, in his turn, stimulated to it, would it not be very profitable to the tenant, as well as advantageous to the proprietor, in clothing our naked and barren wastes, even in inland districts, now when roads are brought to such a degree of perfection, and bridges erected throughout almost all the districts

of Scotland? By which means, profit, as well as ornament, may be obtained, besides the great advantages in affording shelter to the tenant's sheep and cattle in cold mountainous places; as is shown in the section on planting in this work. But, above all, the great advantages resulting from this mode of procedure, cannot be enumerated where the farm is in the vicinity of sea carriage. Were I the tenant of a farm, I would not leave one inch of it fit for labour unoccupied. What would not bear one kind of tree would bear another, and what was too wet for trees would carry hoop willows; which are equally profitable, and can be reaped every three years. And were I the owner of 2000 acres of land, I would plant (if I wished to make money) 1500 acres of them.

I have no doubt, from what has been said, and from proof positive, which will be seen in the sequel of this volume,

that the unprejudiced reader will at once be convinced, that, by judiciously planting, and rearing trees, the exhausted funds of the government may be made up, the nation always kept independent, the exhausted landholder enriched, the country beautified, and the distressed agriculturist relieved. Some will be ready to say, that, if my plan be adopted, there will soon be an over-supply of timber—let it be understood, that, what is meant is only the waste lands, such as can neither be cropped nor pastured to any advantage, and yet would carry timber. The number of acres fit for this purpose in Scotland has already been noticed. It will be a long time before the mountains of Scotland are covered as they were in old times. Through the whole of the extent, for upwards of nineteen miles, from beyond Tyndrum to Tyanne, on the King's House, through the upper or eastern portion of the Glenorchy

division, decayed roots of trees, many of them of large size, appear on each side of the road, in the lower parts of the mountain sides, and in the intervening curries and narrow dells ; and on the banks of the rivers and lakes, also, patches of natural fir, and other trees, may be seen, affording the strongest indications that the tract was formerly covered with a forest of wood. Indications of similar forests can hardly be questioned, as spreading over all the valleys, hills, moors, and mosses, of Scotland ; although, in many places, these marks are not so distinctly visible as in this quarter ; where the decay of a considerable part of the forest has been but recent, and where some of it still exists.

Much of these extensive forests was cut down from various views, chiefly to prevent their affording shelter and rallying points to those who maintained the independence of

the nation during the efforts that, in different ages, were made to subdue the country ; as also a great part perished by natural decay ; the pasturing of sheep and cattle on the ground where they stood, and want of inclosure, effectually prevented their reproduction in the highland parts of the country. A ship of immense size having been constructed at Syracuse, by the celebrated Archimedes, 200 years before the Christian era, a proper main-mast could nowhere be found for this ship but in the mountains of Britain. The Emperor Severus employed, in the year 207, legions of auxiliary troops and natives in cutting down the forests of Scotland, in which undertaking he is said to have lost 50,000 men, probably from the pestilential effect of the swamps, as well as the opposition of the Scots. At a much later period, 24,000 axes were employed by John Duke of Lancaster, for the same purpose.

Besides, large woods in the north were cut down and burned by the Danes ; some forests near Inverary were destroyed by King Robert Bruce, in an expedition against Cummin ; and the following order by General Monk, to cut down certain woods about Aberfoyle, is yet extant.—“ Whereas the woods of Milton and Glenshort, in Aberfoyle parish, are great shalters to the rebels and mossers, and do thereby bring many inconveniences to the country thereabouts—these are to desire you, on sight heireof, to give order for the cutting down of the woods with all possible expedition, that so they may not any longer be a harbour or shelter for loose, idle, and desperate persons; and heireof you are not to fayle. Given under my hand and seale, at Cardrosse, the 17th May, 1654, (signed) George Monk. To the Right Honorable the Earl of Earth, (Airth.)”

These circumstances sufficiently account for the bleak and naked appearance of many of the hills and moors of Scotland, which were once clothed with the finest forests; and much has been done, and still continues to be done, to restore this woody covering, although in several places recent plantations have been grubbed up, when they were injudiciously formed on ground more valuable for pasture or tillage. Large logs of oak, and other trees, have been, and still are discovered in the highland mosses, even on the north of the river Tay; as also on the north, south, and west of the river Forth. Would it not be a very rational conclusion to draw from this, that the large mosses in Scotland, &c. arose from, or owe their origin to trees? For my own part, after all the volumes that have been written, and conjectures formed on this subject, and that, too, by men of talent and ingenuity, I am perfectly of this opinion.

Every one knows, who has in the least degree studied the subject, that when timber is allowed to rot effectually, exposed to the open air in the fields during its decaying, there is a something that grows annually from it, and, of course, adds to its quantity ; when totally rotten or decayed, and when the whole is found entirely corrupted and covered with earth, &c. it forms a kind of moss. There is a large oak tree in a moss on the estate of Brucefield, in Clackmannanshire, which was come at on draining the moss, and found to be of such an enormous size, that it was scarcely possible to move it, so that the men dug under it, and flattened it on the upper side with axes, and it lies to this day, forming a bridge for carts to cross the ditch. The immense number of trees on the ground in these forests, the prodigious sizes they had arrived to, the number of ages they had stood ; raising the surface of the ground by the

annual shedding of their foliage ; the prodigious thickness of their trunks, the immense number of their enormous branches ; add to this the annual productions of nature, since they were cut and began to consume, besides what must have been carried to them by the overflowing of rivers, &c. and it need create no surprise to think of the thickness of the moss above the soil from which these trees at first sprung. Besides, it is obvious that a great many of these trees were of the fir tribe, and would consume much faster than the oaks ; and their foliage, both annually and ultimately, would add a great deal more to the mossy substance.

Since the author formed the intention of publishing, he has received the following letter from a gentleman in Edinburgh ; and trusts the matter it contains will form a sufficient apology for its insertion.

yards. The author, upon trial, has most completely checked the progress of rot in timber, when it was most rapidly advancing; and has also brought the most open porous timber of all kinds, that could not, when made into vessels, or casks, be kept without leaking, to such a degree of consistence and so impervious a state, as to resist blowing, and to keep perfectly tight with spirits, or any kind of liquid; and, of course, the timbers made more durable.

THE
FORESTER'S GUIDE.

SECTION I.

PLANTING.

IT will naturally be expected by some, that, on treating of planting, the author should commence with the Nursery; but he confines this work solely as a guide to the Forester, who, if possible, should be the planter of those plantations he is to have the charge of rearing. A man may be a very good gatherer, preserver, and sower of

and rear up to proper maturity ; to know the most profitable purposes each can be applied to, and bring them to the best account when they come to be cut down.

Allow me in so far to infringe upon my pledge as to the nursery, to recommend to every proprietor, who intends to plant to any extent, to set aside a small spot of land for the purpose of rearing seedlings fit for planting out. The spot for this purpose should be well sheltered and dry, and the soil and situation as nearly akin as possible to that in which the trees are to be reared. A selection of seedlings, say one, or not exceeding two years old, should be made of the various kinds intended to be afterwards planted, and these put into the nursery, and allowed to remain two, three, and sometimes four seasons, may be necessary for some kinds of plants, carefully selecting and planting them out into the place where the plantation is to be reared, always taking the different sizes and quality to suit situation and soil, as seedlings of all kinds can

be got in abundance at all times from the nursery, and that too, at very reasonable prices. Nothing can be more advantageous for the proprietor who intends to plant, however small the quantity, than to have a small spot, as a second-hand nursery, so to speak, and to give the plants two or three years in it before planting them out, thus naturalizing both to climate and soil, in a great measure ; and the expense of keeping up a nursery of this kind is, in rearing from the seedling to the plant, so very trifling as scarcely to deserve a name. Indeed when a proprietor has very extensive plantations to rear up, he may have a nursery of his own, and rear his plants from the seeds ; but still the expenses of keeping up such a nursery will be found to be much more than buying in seedling plants. When a proprietor's land, intended to be planted, holds a local situation near a nursery, this may not be necessary ; or when the soil and climate to be planted is nearly akin to that from which the plants can

be got. But I would lay it down as one general rule to be observed, that the plants be reared from the seed or seedling in ground and climate, as nearly akin to that in which they are to be planted as possible ; the poorer the ground is, from which the plants are taken, so much the better will they thrive when put into richer ground. How often have we seen plants taken from a rich, good, warm soil, and planted into a poor, cold, exposed soil, not grow one inch in eight, or more years, and thousands of them die altogether. And even those that grow, did not make above half the progress they should have done in twenty years. So much for raising the plants, let us now prepare the ground for planting.

The great advantages of planting has already been, I trust, sufficiently made good in the introduction ; and as rich good land that may be planted chiefly for ornament, needs no preparation, and confining myself solely to land not fit for carrying any other kind

of crop, and to plantations intended solely for profit, here having to contend with soils altogether unimproved, and some of them (*say moss,*) the improvement of which has been but little attended to, I may here be allowed to say that the planting of such land is an article of vast consequence to private individuals, and their value to the possessor may be made such as even to recover a half-sunk estate : taking also into consideration, that the time may not be far distant when, as a nation, we may be shut up within our own bounds for a supply of timber, which would raise the price of it to such a degree as would not only far exceed, but triple the profit mentioned in the introduction ; so that, upon the whole, it is impossible to name any one thing, a landed proprietor can do, that is more for public and private advantage than planting. It is cheap, it is easy, and it is of all methods the best in which a proprietor can make atonement to his successors for his own extrava-

gance ; and he who sets about it with spirit, should consider he is working for himself, his heirs, his posterity, and his country. The first kind of land we shall treat of improving by planting, shall be moss. Of this soil there are numerous and extensive dry tracts in the hollows and in the declivities of hills in the interior of the Highlands. These lands are generally covered with heath, and so little grass, that they are not in their present state worth sixpence an acre. The most simple, easy, cheap, and most effectual method of improving these mosses is the following. And here I must introduce a newly invented plough for that purpose, which I may denominate the three-coultered moss surface-raising and draining plough, (for its make and manner of working see explanation of the plate,) as it will answer alike well for both these purposes.—In dry moss land, divide it into ridges of seven feet broad ; as this plough cuts two furrows at once, run the plough up each of those divisions ; if the surface is very full

of strong heath, take a furrow of four inches deep ; if the soil inclines very much to moss, and little sward upon it, the furrow may be cut six or seven inches deep ; if the ground is very full of strong roots of heath, &c. it may be necessary to take the furrow to the proper depth twice—say four inches the first furrow, and if the ground is a little inclined to wet, and of a very mossy substance, the second furrow may be six or seven inches deep ; this can be the more easily done, as the plough is constructed so as to make a very deep furrow even to fifteen or eighteen inches, and the horses always working on the solid surface, or what is commonly called the selion. In general, it may be better to take the furrow at twice, both for ease to the horses, and to have it cut thin for the purpose it is to be afterwards applied to. The ground to be planted is the selion that is betwixt the furrows, and the plants are to be put in at three feet distant from each other, being two plants in the breadth ; but these are not to be put straight across, but in an angular

form, to stand so much lengthwise in the ridge that each plant will stand eighteen inches from the edge of the furrow, and three feet betwixt the plants. Thus having divided the ground, and fixed the spot where each plant is to be put in, cut the surface turf that was first turned up by the plough into paces, or lengths of eighteen inches each, and collect these by fours or sixes, to the spot where the plants are to be put in; set them up on end, with the upper ends bearing on each other, and spreading them out at the ground, so as to leave a space in the middle, to allow the air to pass through to dry them; and when they are found properly dried, they are to be burned. Thus having (as has been already said) two turfs on both sides the whole length, and the plants to stand at three feet between each, there will be four turfs for every plant; but if the soil from which they have been paired off is very poor, and not many roots intermingled, it will not burn, it will be necessary to add a little dry heath, which

may be got on the ground, or dry furze under every heap; or if two furrows have been turned up, and the second very poor or nothing but moss, this may be cut into small pieces as peat, and dried as such; and these added to the heaps, will not only make them burn freely, but also add to the quantity as manure. But if the soil is well clothed with heath or any other stuff, affording a great many roots, the plough being constructed to cut, and throw two furrows each five or six inches in breadth, and going four or five inches deep, as occasion may require, this will be found quite sufficient for making a soil to receive the plants in dry moss land.

Supposing the moss to be very wet and level, having little or no declivity for the water to run off, divide such into ridges of forty feet in breadth; cut a ditch six feet wide at the top, three feet wide at the bottom, and four feet deep, allowing these to stand open; and having, before cutting these

drains or open ditches, laid the ground open, as before directed, with the surface-paring or draining plough, take a spade, and give each fur or space opened by the plough a gentle declivity towards each ditch, to carry the water into them, and then burn the turfs, as directed, on every spot where it is intended to put in the plants. It may be here necessary to explain more fully the simplest and best method of burning the turfs, &c. A very easy method of cutting these turfs into lengths is, by making a roller of the trunk of a large tree, placing a cart or box above it, as is often done in the common roller, and fill it with stones, to add sufficiently to its weight to make it cut the turf; and this it can be made to do, by hooping it round at every eighteen inches, and from the middle of each hoop to arm it with a blade all round about, six inches deep, stout at the bottom, to prevent it from bending, and sharp at the edge. The roller thus armed, is to be drawn over the whole field crosswise, so that

its weight pressing the sharp edges down through the turf turned up, the whole will be easily cut into lengths of eighteen inches, &c.

Having thus given a very convenient and expeditious method of cutting the turf, we are to proceed to the drying, piling, and burning of it, (part of which has been already described ;) but as this is a part of the work in which some expense may be saved, and the principal advantage and end obtained, we must be a little particular ; for, however plain and simple this operation may seem, a great part of the benefit the plants and the planter are to reap from it, depends on a very critical attention to every part of the process.

“If the soil be light, and the weather warm and dry, the turf will dry with once raising up and turning ; but if either its own dampness, or the wetness of the season prevents this, it must be piled together as open as possible in little heaps ; where passage being left between the turfs for the wind, they will

quickly be dried. Sometimes just setting them on edge against one another will answer the purpose.

“ When they are dry enough for burning, the turf will, in some places, burn singly and of itself ; in others it must be assisted with more inflammable materials. The planter may know whether he must burn it alone, or give it this addition by observing its nature as it is turned up.

“ When the soil is very poor, the turf thin, and few roots among it, it will not do alone. On the other hand, where the soil has been better, the turf cut deeper, and there is a great deal of roots in it, and stalks and dry leaves upon it, it will burn alone, and he needs to give it no addition.

“ In the other case, he must strew a little dry heath or dry furze under every heap, and if it be very poor, he must mix some of the same dry and inflammable materials among the several turfs of every heap ; for it is not only by means of the ashes that barren or

moss grounds thus treated are improved, the very heating of them by these several fires tends to divide their particles, and to increase their fertility.

“ The number of turf sufficient for each heap has been already described, and if they are of the poor kind, a little dry furze should be laid upon the ground under and between them ; this is all that is needful. The planter or labourer, then, is to set them up end-ways, and edge-ways, as open as he can ; and when all the heaps are thus raised, and have stood a day or two for a farther drying, the furze is to be set on fire ; and they will catch from it, and burn away sufficiently for the purpose.

“ Let us now examine the matter of burning them ; for, on doing this properly, as much at least depends as on any part of the work ; for, after all the toil and expense, two-thirds of the advantage, from the single circumstance of not regarding, or not knowing the proper degree of burning, may be lost.

“ Now, in order to explain this, it is to be observed, that fire carries off all the efficacious parts of most substances ; but this it does gradually, and the progress may be seen. The planter wants to reduce this turf to ashes ; but as he wants these ashes to enrich his land, he should get them as full of virtue as he can.

“ If a plant of any kind be put into the fire, it burns away to ashes ; but these ashes at different times of the burning differ very much in appearance, and also in their qualities. When the plant first falls into ashes, those ashes are of a blackish grey ; and as they continue in the fire they become paler and paler, till they are at length perfectly white. While they are of a dark grey, they have a great deal of taste, but when they are burnt white, they are only a little brackish.

“ Let the planter mark the course of the operation in the burning of one of these heaps of turf. He will find, provided the fire go on well, that at first all the heap

looks blackish and dusky ; then the turfs which compose it, after a time, begin to crack, and crumble to pieces : a little while after this, he will see them moulder into an heap of reddish or yellowish ashes, with several lumps among them ; and a while after this, a great part of the lumps will moulder away, and the ashes, in most parts, become of a pale grey ; and in some places whitish.

“ It is easy for him, from the before-mentioned directions, to know in which of all these states the turf is fittest for his purpose. While it is black and holds together, it is burnt but imperfectly ; when it begins to crack and crumble to pieces, it comes nearer to a condition for his purpose : but the true state in which it is to be used is, when it is mouldered to pieces, but yet retains a yellowish or reddish colour : the ashes are at this time thoroughly made, and yet they retain their full virtue. After this, every minute that they continue on fire, they lose some part of their strength.

“ We are now naturally led to consider the proper degree of heat, for bringing the turf to this state, with least loss of the virtue in burning.

“ All violence of heat wastes the virtue of the turf, which the planter wishes to remain in the ashes: therefore he is to contrive to burn them by a slow and mouldering fire. For this reason, the less additional fuel he uses the better: and that there may be occasion for as little as possible, he will do well to first dry the turf as perfectly as he can. It is for this reason also, principally, that the ashes made from rich turf are found better than those from such as is poorer, for the rich kind consumes by itself, and that slowly.

“ To preserve the full virtue of the ashes, a slow smothering fire is best; similar to the burning of charcoal. And the planter is also to recollect this, that the inside of his heaps will be always more burnt than the outside, so it is enough, in many cases, if the

outside be well cracked, and ready to break to pieces with a small blow. In this, however, no general rule can be given, for the nature of the turf differs so much, that some will hang together till struck, when it is over-burnt, and other kinds will break and fall in before they are half reduced to the proper state. I have taken the only general method ; that is, informing him of what is the right state of the burned turf, for giving its full virtue. And his eye must watch this, and take the proper opportunities of continuing or stopping the burning when it is needful.

“The planter may guess, by the nature of the turf, what degree of fire it will bear, and what addition of fuel it will want ; this he is thoroughly to weigh beforehand, for on this a great deal depends. The practice succeeds best when the heaps burn just as long as they should, and so may be left standing whole upon the ground ; and this will depend upon the quantity of fuel, joined to

their own particular nature. If too much fuel have been given them, and they from thence continue burning within, after the very outside is done enough, then he is to break and spread them a little, so as to make them go out; but it is much better when they go out of themselves, and remain properly calcined and whole: for when they are thus broke and scattered, if a windy day come, half the ashes will be blown away."

We shall suppose, therefore, according to the directions here laid down, the heaps so well made, and the fuel so justly proportioned to the nature of the turf, that the heaps are all sufficiently burnt and many of them stand entire; or, whether they do stand entire or not, even before they be quite cold, the planter should now set his men to work, and go over every heap; break them down; dig up the solid surface on which they have been burned, at least two feet square round where the plant is to be put into the ground, and not less than a spade-

length deep, mixing well the burnt ashes with the soil upon which these were burned. Thus the ashes of the turf will not only fertilize the ground, but this very act of burning, say the real and actual effect of the fire, does great service to the land, particularly when cold and wet before, so far as it reaches, and renders what was before nothing but a barren waste fit for vegetation.

The best season for undertaking this business is about the middle of May, for at that time the surface of the ground is generally in a good condition for burning. The April rains have made the roots shoot out, and the ensuing warmth has dried it. Beginning at this season also, he will have time for waiting every opportunity, to take advantage of weather, and all accidents, and will have his ground in thorough order for his plants next winter or spring.

Having now prepared the moss ground for receiving the plants, let us attend a little to the kinds to be planted in such soils ; and

here I would lay it down as an invariable rule, in the soil I have been treating of, as also in all moorish and heathy soils, always to take care to burn the heath and all rubbish of their surface before putting in the plants, and also on all land that requires a soil to be formed; to plant with larch firs, and nothing else, at three feet distant, plant from plant; and let it be here observed, that these plants should not be more than two years transplanted from the seed-bed, and let them be transplanted from the seed into ground and climate as nearly akin to that into which they are to be reared as possible. The ground having been thus previously prepared when the plants are put in, they will be found to grow very rapidly, and will get and keep the ascendancy of every other plant as well as all kinds of weeds; and when once above, will kill the strongest whins, broom, heath, &c.; and it is well known, that when there is nothing but larch firs, they even make grass to grow upon the barest soils. If the

plantation is intended solely for larch firs, which is very profitable, as will be shown in the sequel, they must be thinned out gradually year after year, before they attain a height of more than twenty feet, to stand at equal distances of twenty feet, tree from tree, a distance quite sufficient for rearing the larch fir to full maturity ; but this is more fully described in another part of this work. But if the plantation is intended for hard wood, say oak, &c. as there is no kind of soil, however poor, if kept dry, and prepared by larch firs from seven to twelve years, as it may require, but what will carry oaks and other hard wood ; and if this is intended, and the larch for the most part being in a thriving condition for the first five or six years, early in spring sixth cut out two larch firs alternately, and put in one oak for every two larch firs so cut out, thus converting the whole into a plantation of oaks at six feet plant from plant. And as these plants of oak thrive and come forward, cut away all

the larch firs ; the oaks thus managed will be found to make great progress, so much so, that not one plant among a thousand will go back. If any oak plant should die at the top, before it loses the growth at the root, be sure to cut it over close with the surface of the ground, slanting it upwards. If this is properly attended to, the plants so cut over will be found to make most rapid progress, and will soon equal, if not go beyond the plants that still continued to grow. Let it be here observed, that oak plants put into situations of this kind, should be very strong, not less than from two to three feet high when put in, and not less than three or four years transplanted from the seed-bed; and care should be taken in putting them and all such plants into the ground, to give them a good large pit, so as to hold a considerable quantity of loose earth about the root; and when put in, the young fibres of the root should be carefully spread out; and by no means should the fibres be pressed into

hard solid earth, so as to twist and break them, which is a great means of retarding the growth of the plant : and, indeed, I have oftentimes found this careless method of planting and putting in the plants, particularly when large, to be the very means of killing them altogether. I would lay it down as an invariable rule, that all plants be thus carefully attended to when put in, as it is a great means of causing them to strike immediately at the roots, and also of furthering their growth and prosperity afterwards. Suppose now, that there is a crop of oaks on the ground at six feet from each other, and suppose the ground to be converted into an oak coppice or natural wood, to be cut every twenty or twenty-four years, which will be found to be the most profitable of all plantations ; the whole of the firs should be cut away from them as soon as they are of sufficient strength to be exposed to the weather by themselves, and this may be done when the oaks have arrived at a height of six or seven feet, but not

pen can accurately fix the number of years it may require to rear them to that height. I have seen some, when the soil was good, and planted in this way, arrive at the height of six and seven feet from the plant in four years; but when the plants have been cut over, and, originally intended for coppicing, and the shape of the plant not much regarded, I have often seen them grow from six to eight feet in two years. Should any of the plants, or what we may now more properly call trees, go back after the firs have been all cut away from them, or even get stunted in their growth, all such should be immediately cut over close to the ground, as formerly directed, and thus having a healthy root, they will be found to make most rapid progress. Keeping up the number of trees at six feet upon the ground, will be, for the first cutting, a complete crop for a natural oak wood. As soon as they are fifteen years old, the whole should be cut over; and although the bark will not be

so very good in point of quality as at twenty or twenty-four years old, as it will be much thinner, still the ground being covered with trees at six feet, and the soil being sufficiently strong to afford the whole good nourishment to that age, the quantity of bark will be such, in ordinary cases, as to produce four tons of bark on each acre, which, valued at L.10 per ton, will be L.40 per acre for fifteen years growth, which will be found upwards of L.2 per acre of annual rent, after deducting interest and expense of planting. But the most powerful and weighty reason for my recommending the cutting of a wood, intended to be reared for a natural or coppice wood, at fifteen years growth, is, that the stools have now attained sufficient size at the root to carry two, three, and four stems for the next cutting, which should be done in twenty years after; and if it is properly attended to, as recommended in the section on Rearing of Coppice, it will pay at least three times more by next cutting. This will

be found to be the most profitable of all planting, and the only method by which a proprietor can have a regular annual return. Suppose he has from one hundred to one thousand or upwards of acres turned into this kind of oak woods, and divided into regular *hags* or annual cuttings of twenty or twenty-four years old each, he can have a regular annual income from them of from L.2 to L.6 per acre for ever after, without the expenses of a single plant; as oak stools, by leading them out at the end of each cutting, so as to occupy new ground, never will run out, and that too from land that was not formerly paying him one sixpence per acre. But, supposing the plantation to be reared up for timber trees to maturity, say, as a forest of useful valuable timber trees, then it will be most essentially necessary to consider what is the kind of timber that brings the best price in that part of the country where the forest is to be reared; and those trees that will bring the most money, and meet

the readiest demand, should, by all means, be planted ; but in wet moss-land, those kinds of trees whose roots strike deep will not answer so well as in dry land, although a good deal inclined to moss. When the soil is once properly prepared, almost any kind of tree can be reared to maturity, as may be seen in many parts of Argyleshire, where trees of various kinds are seen, of large dimensions, growing from nothing but moss, excepting what soil their foliage may have made on the surface ; and besides, there are many indications of large roots of oak and other trees still remaining, not yet decayed since cut down, in moss-lands in North Knapdale, and along the sides of Lochfine, down towards Tarbart. I would recommend as the most profitable timber trees in almost all parts of the country, the oak, Spanish chesnut, Scotch elm, ash, and plane. As to these trees, see the purposes each is suited to, and used for, with their value, in another part of this work. But, supposing the plantation to be turned

into a lawn, and to be used as pasture, to have it interspersed with beautiful trees, to give a variety and grandeur to its aspect, almost all the different kinds should be reared. And here it may be proper to recommend a few of the fir tribe, say the Scotch spruce and silver firs ; as these grow to a large size, and live to a good old age ; the other kinds should be oak, Spanish chesnut, Scotch and English elms, ash, plane, and beech, and these trees should be put in alternately, one kind after another, at a distance of nine feet, plant from plant, so as they can be thinned out gradually, first to eighteen and then to thirty-six feet distant, tree from tree, at which distance they may stand to maturity in a lawn. In this case three larch firs should be cut out for every plant to be put in ; these plants as recommended in the oaks for coppice, should be good large plants when put in, as the larches will afford warmth and shelter to them, so that there is little risk of their going back in growth.

In all places intended to be planted, where the soil is very poor, though not moss, I would recommend to plant larch firs in the way and manner directed, to make and prepare the soil before putting in the trees intended to be reared up; and wherever the ground is covered with heath, whins, broom, or any other kind of stuff, it should all be burned up before putting in plants of any kind, although there may be no necessity for burning part of the surface to enrich the soil; and this will most effectually save the labourer's task, as well as expense, of filling up with new plants yearly; as in this way, and by a careful attention to the pitting and putting in the plant, not one out of one hundred will die; whereas, if allowed to be choked by weeds, &c. fifty out of one hundred may require filling up annually. This I have often seen, and could give many proofs of, as well as the planting of deciduous trees amongst fir, particularly larch, although the plantations should be consider-

ably advanced. If care is taken to thin out the larch so as not to drop upon the plant, still I will affirm, that there is not a more speedy and sure method of rearing hard wood plantations than by planting larch firs for a few years before putting in the hard wood plants, especially when there is soil to make. This I have practised, and recommended to all my employers for these number of years past, and have had the satisfaction of seeing the most unexpected and flattering results from it, and could give many instances of their most promising success. One observation founded upon actual experience is undoubtedly worth five hundred plausible theoretical conjectures, and will ever be so estimated by the ingenuous inquirer after truth. Although I have not experienced that of the moss planting in an extensive degree, yet, if it does in a small clump or strip of planting, it will do much better in an extensive forest; and if the few experimental hints I have given shall induce the

proprietors of such land to adopt the plan, I am convinced they will, in their happy experience, reap the benefit of it, so that I shall not deem the little pains which I have bestowed upon this subject as thrown away. Attached to no theory, and having no favourite system to support, I invariably follow truth founded on experience, in however plain a dress my want of appropriate language obliges me to state it.

The next kind of uncultivated land or lands, not fit for any kind of culture, which we shall consider, and endeavour to plant, is that of rocky soils, particularly whin rock. Of these there are many thousands of acres through Scotland, that, like the moss, does not bring in one sixpence of annual rent to the proprietors; which could also be planted with wood, and will, in many places, carry fir, oak, and other trees, to maturity; and, in every place, excepting where there is a great proportion of bare rock, coppice oak can

be made to grow to be cut every twenty-four years. As a proof of this, I need only call the reader's attention to almost all the Highlands of Scotland. Those who have travelled in almost any part of them must have been struck with agreeable surprise, on beholding oak trees of a very considerable size, and thousands of beautiful natural stools of oak, growing out of the very chinks of the rock, where there is scarcely any soil perceivable. Should this fall into the hands of any reader who may never have been in the Highlands, he may learn the truth of it from those who have travelled; or should it fall into the hands of any who may yet travel, allow me to call their attention to the shores of Loch-fine, on many parts close on the side of the public road, from Tarbart up to Inverary; the shores of Lochsween, particularly about Tainish, and the whole of the woodlands in North Knapdale, Loch How, and many more places both in Argyle and Perthshire, where proofs of the above can be seen, which will lay a

sure foundation for establishing the truth and possibility of the following method of planting all such places ; a method which is cheap, simple, easy, and most effectual, although new and opposed by almost the whole of the nurserymen, the reason of whose opposition I am at a loss to discover ; for, besides the many undeniable proofs of trials of my own experience within these several years, particularly since I published the first edition, ten thousand proofs stand clear as a sun-beam, in hundreds of places where no human foot ever trod, or voice was ever heard, except the foot of the woodman, and sound of his axe.

The system or method of planting all such land is, *first*, by the acorn or seed of any tree, and, *secondly*, by layering from double shoots of young saplings.

First, By seeds on rocks. In all places of the rock where there is the least chink, though almost close, and only perceivable by the eye

for one or two feet in length, if in any degree level, or if not, it may be made so much so, with a stone pick, so as to hold one or two spadefuls of earth ; then take the quantity of earth, and put it upon that part or chink of the rock ; firm the earth well, and then put in the seed half-way between the chink of the rock and the surface of the earth, and firm it well above the seed. When the rock is of itself level to carry it, put a larger quantity, say not less than three or four spadefuls of earth together, and put in three or four seeds ; where this can be done, it will so much the better answer the purpose they are afterwards intended for. Here I would chiefly recommend the acorn, and it alone, when it is solely intended for profit, as a natural coppice wood ; but should any place of this kind be required to be planted for cover or ornament, the Spanish chesnut, the elm, the ash, or the plane, will do nearly as well, and will give variety to the aspect by mixing them. From the reflection of heat

on these rocks, the progress in growth that these seeds will make in one season is truly wonderful. I have often known the acorns grow more than in the best nurseries. Let it be carefully noticed, that, when there is no natural soil, but what is carried to it, whatever progress the seedling has made above ground for the first, second, or third year, every year's growth must be cut over at the end of the season, say in the month of October, cutting it always close by the surface of the earth. By this time the roots will have made considerable progress into the chinks of the rock ; nor will any thing be lost by the third year's cutting, as it will make more progress in the fourth year's growth by being cut, than it would have done all the other three, though allowed to grow without being cut, and has no such chance afterwards to fail ; or should it, at any future period, have symptoms of decay in the top, let it be again cut over close by the ground. In places where shelter, cover, or ornament is chiefly intended, and where there may be any

natural soil, say to the deepness of nine or twelve inches, some of the fir tribe may do best, as the roots of the most of firs only run upon the surface. But although they may stand for a few years, they either decay, where the soil is very thin, or are apt to be blown down; whereas the roots of the oak tree strike down into the chinks and crevices of the rocks, and find nourishment, and will come to maturity, or, so to speak, to perfection. Wherever there is natural soil at the foot, by the sides, on the top, or in crevices of bare rocks, if the soil is even to the depth of six or eight inches, although the rocks be perfectly bare to the distance of twenty or forty feet from all such places, there is no occasion to carry soil to plant the bare face of the rock in such cases, where there is soil within thirty or forty feet of height or breadth, for it can be carried over this by layering from the plants, as afterwards explained; but put in large strong plants of the kinds of hard wood we have already mentioned: let none of the plants when put in be less than two

years seedlings, and three years transplanted ; plant these properly by pitting, as before advised ; and as soon as they are properly put in, cut the plant over close by the ground. This relieves the plant at once of every incumbrance above ground, such as shaking with the wind, &c. and gives it every chance of striking at the roots, without the least risk of going back, and is of the most essential service to it in exposed situations, as will be afterwards shown.

These may be cut over more than once if necessary, but not unless they get sickly at the top. Nothing is lost by cutting even to the third year, or, I should rather say, every thing is gained by cutting. As the roots receive additional nourishment, not a single fibre loses a moment of vegetative life ; and when all these fibres are full of life, they send up in the moment of active vegetation such a degree of nourishment to the young sapling, as to give a shoot often from three to six feet in one season, after the second or

third year's cutting. To strangers this may appear surprising, and many will be apt to call the truth of it in question, particularly as few have ventured upon the same ground; but let those who doubt try it in a few plants. This is making no great sacrifice; and I can confidently aver, they will soon experience the truth of it. I would have it laid down as an invariable rule, that to cut over the plants for the first two, three, and sometimes four or five years, as may be necessary, is the cheapest, speediest, and most effectual method of rearing plantations of the oak, the Spanish chesnut, the elm, the ash, the plane, the birch, the alder, the lime, the Huntingdon willow tree, and common saugh; and these are the only profitable forest trees, with the black and every other kind of poplar. But the poplar will grow in moist or wet places equally well without cutting. One argument against cutting is, that a far better shaped or prettier tree can be reared from the plant than by cutting. I grant

that when ornament is chiefly the object in view it may be the case; but I also aver, that if proper care is taken in pruning and training it up till the tree is eight or ten feet high, the one reared from the cutting may be made as ornamental and as beautiful a tree as that from the plant. The manner of pruning them is shown in another section of this work.

Let me here strictly enjoin the planter or forester to examine his plantation annually, and whenever he sees a plant of the kinds mentioned, should any thing like decay in the top be seen, to cut it over close by the ground, whether it be a plantation of trees for ornament or profit, as by so doing you not only save the expense of putting in a new plant, but thus, while there is life in the root, you save one, or perhaps three years growth of the plantation. But, says the nurseryman, although a plant die the first or second year in the top, which many hard wood trees generally do, and indeed sometimes stand still without making almost any perceivable

progress, still these plants, while they retain sap in the roots, always send out a shoot, and sometimes two from the eyes nearest the root, and these form the tree. This, I grant, is true in general, although thirty out of the hundred die altogether ; but what kind of a tree does it make ? After two and sometimes three shoots come away, each contending for the superiority or main leader of the tree, so that you have it always with two, and often three tops all pushing out in a horizontal direction, what poor pitiful trees do all such make ? Will this ever make a rapid, growing, healthy, or ornamental tree ? No ; it never will. As a proof of this melancholy fact, let a proprietor enter his plantations wherever they are, say from three to eight or ten years old, and, if any thing extensive, thousands of proofs of this will strike his eye on every side. But again, if these plants that die in the top are allowed to stand year after year, depending upon their sending out side shoots from the eyes at the

roots, which many of them never will do, they die or lose the growth at the root, and then the plant with its two or three years growth is lost. But, says the nurseryman, "when the plant dies at the top, and no appearance of its sending out side shoots, only one or two years growth may be lost, which cannot be helped: Put in new plants, beat up, keep it full with fresh plants." This may be all very well for a nurseryman, but not so for a proprietor; but such is the case.

I have known, and could give name to several plantations, where they had been beating up, as it is called, for six, eight, and nine years, and at that age it was not a finished plantation. In one of these plantations referred to, I caused a number of these plants that were six years old, but so unshapely and unthrifty as never to be proper trees, to be cut over, and in one season most of them made a push of from four to five feet, which was a greater height than they

had gained for all the six and nine years before. In January 1823, there was a very heavy fall of snow in many counties of Scotland, such as had not been for near a century before, which did great damage to the young plantations. The snow was blown to a great height, so much so as to overtop the trees in a belt of planting on the estate of Airthry, about ten or eleven years old, called Spittle Hill, consisting of oak and firs. The soil being good, many of the oaks had attained a height of from six to ten feet, and from one to two inches in diameter at the root. When the snow subsided, many of the strongest of the oaks were broken, and twisted as it were to pieces, which rendered them perfectly unfit to remain as trees. Sir Robert Abercromby desired me to look at, and say what should be done with them. About the last week of April, or first week of May, I made Sir Robert's forester cut them all close by the ground; all those that were an inch and a half in diameter at the root, I

caused to be rounded down close to the earth, in the same way as dressing a stool of oak, at six or eight inches for the growth in a natural wood ; and before the first of September many of them sent out two or three strong shoots from three to five feet high, some of them nearly as tall as the plants were, before they were broken down. The smaller plants were cut in the usual way with a slope, and generally sent out but one shoot.*

The nurserymen say, put in new plants ; but I say, cut over, to obtain a cheap, sure, and quick plantation. It is evident a great expense will be saved in plants and planting.

* Sir Archibald Campbell, Bart. (Lord Succoth,) had a plantation wholly of oaks on his estate of Garscube, which had stood for upwards of fifteen years, and, although on good soil, never were so healthy and thriving as was expected. Although every attention was paid to the rearing of them that possibly could be, still they became stunted in the growth. His Lordship ordered, I think, nearly about the one half of the plantation to be cut over close by the ground, taking the worst side of the plantation ; and such was the result, that those cut over sent out such vigorous growths, that many of them the first, and all of them the second year, gained the ascendancy over the fifteen years old plants, nor did a single one of them misgive that had sap in the root.

Secondly, By layering. This is a system or method of planting in forests entirely new, and I believe, or at least as far as I ever heard, was never so much as tried by any but myself; but this I have practised for these number of years back. I have tried it with the most universal success, and from experience have recommended it to all my employers, many of whom are now reaping the benefit of it. But here I have got the whole body of nurserymen against me; and when a gentleman speaks to them of layering forest trees, for instance, oak, they at once declare it to be nonsense, chimerical, impossible, and a scheme that will never succeed. Nothing will do, say they, but planting; You must plant. But why condemn a man before he is found guilty? I am not to be driven out of the path of duty, to serve the selfish views of any man; besides, I can have no more interest in lessening the expenses of planting to a proprietor than in selling plants for a nurseryman; and I am convinced, that every

improvement in planting and rearing of trees, particularly the oak, must be a national as well as an individual benefit; and no improvement of that kind, however trifling, from whatever quarter it may come, should be withheld from public view.

The method of layering from the sprig of a plant is well known to all nurserymen; but we must carry the matter a little farther when we go to the forest. The method of layering in forests, which is agreed on by all those who have tried it, is of the very first and greatest advantage in filling up blanks in a natural or coppice wood; and with this we may commence. When the young shoots in a natural wood have finished their second year's growth, say in the month of November or December the second year, (and here, by the way, it may be proper to observe, that, when layering is required, the stools of natural wood should not be thinned out the first year, as is directed in the section on rearing of natural or coppice woods,) every shoot

should be allowed to grow till the layering is performed, the second year's growth being finished as aforesaid. If the stools have been healthy, these will have made a push of from six to nine feet high. If there is a blank to fill up on every side of the stool, take four of the best shoots, and layer them down in different directions in the following manner : take the stem or shoot from the stool ; give it a slash with a knife in the under side, very near the stool or root, to make it bend ; often the shoot at this age will bend without using the knife ; give it also a slash with your knife about one inch above the eye next the top of the shoot. Should there be but one small shoot near the top, and that chance to be next the ground, not to twist the leader or layer, give the shoot a twist round the body of the layer, and bring it upwards. Make a rut in the ground about six inches long, and of sufficient width to receive the body of the layer. Pin the layer firmly down in the slit below the surface of the earth. This may be easily and readily done with a small pin of wood,

about six inches long, with a hook upon its upper end, to keep down the body of the layer; which pins can easily be got from the branches of trees in the wood. Having pinned it firmly down below the surface of the ground, cover over the layer with the turf from the rut; or a little fresh earth may be put in, and press it firmly down, holding up the end of the young shoot from the body of the layer, pressing the ground about the root of it the same as putting in a plant by pitting, &c. leaving also the top of the shoot or stem thus layered down out of the ground. Thus the layering is performed, and in one year, if the root, or stool from which the layer is taken, be healthy, the top shoot, and the shoot to form the tree, say the small shoot or eye from the top, will make a push of at least two, and I have even known them grow four feet in one season. Nor is there the smallest chance in their mis-giving. The top shoot having made a push again in two years of very possibly from eight

to nine feet, it can be again layered down, and led out other eight or nine feet; thus in four years completely planting up and covering the ground on all sides from sixteen to eighteen feet, (and supposing you have stools or roots on the ground at a distance of from thirty to forty feet,) in five years, you can completely plant up the whole ground without the expense of a single plant. Nor is there the least risk of their misgiving in one single case if properly done; and here also you have a plantation of plants, or we may rather now call them trees, of from four to fourteen feet high, which, by putting in plants, you could not have had for twelve years, besides the expense of much filling up. Let it be here observed, that this plan and method of layering will do in the very poorest of soils. When the layer is carried out to the distance required, it may be disengaged from the old stock or stool, as it will have gained at every layer a new root of its own. If only one layer is required, it may be disengaged at the end of two or three years.

Observe, this layering may be performed on shoots or stems of trees from ten to sixteen feet high, provided care is taken not to touch or loose the bark on the upper side of the stem, when you bend it from the stool or root, and, at the same time, you can rear a tree from every shoot from the stem to be layered, taking care always to cover it over with earth, and pin down to the ground the eye or fibre to form the root, in the manner already described; and in cases where the layer is strong, and the fibres strong, cut the shoot, to form the root, within one inch of the body of the layer. Observe also, that, if the layer is large, say from eight to sixteen feet high, and the fibres strong, where the roots are to be formed it may require four or six years before it can be disengaged from the old root, as the larger the fibre the longer it is of striking root; but young shoots, of two or three years growth, will strike the first year. This method of layering may also be performed by bending

down the branches of trees, as is plain from the following letter from an ingenious forester, although numberless proofs of the truth of it could be given.

MR. MONTEATH,

I am very happy to hear of your plan of layering trees in forests. Many years have I contended that blanks of plantations could be filled up by layering. I recollect when I cut the wood of Birkhill in Clackmannan parish, for the Messrs. J. Macmurrich and Foyer, purchased by them from Lord Dundas of Westcarse, that we were allowed six years to cut it. As one of the yearly hags, on the north side, was very troublesome to get the wood out, I was obliged to form a kind of road to it nearly two hundred yards in extent, on which we threw rubbish and brushwood, some on the young shoots, and some on the stools of trees that were cut that season, and got leave to lie. This was in 1808. In 1813, Mr. Landels, factor on the estate, gave orders to his gardener, James Coban, who acted as forester at the same time, to get men to prune and weed the said wood of Birkhill. James Coban being quite ignorant of the mode of pruning came to me, begging that I would favour him by going to show the way of pruning oak, with which I complied, and went a part of a day through with him; and, in going through, came to the old road on which the brush and rubbish were nearly rotten. But the shoots that were laid over with the weight of rubbish were springing in many directions, and new fibres taking root, some two, and some three feet from the stools. But, as there were some standing upright, I cut those that were layering, as there was no blank near them. But this convinced me of what layering could be brought to; and, indeed, in every plantation that I have pruned, I see nature giving

clear proofs of layering ; and, indeed, at the very place that I have been pruning just now, there is a plane tree, or what some people call sycamore tree ; and that wood, when young, is very frush for binding to answer layering ; but nature has caused one of the lower branches to layer out two feet or better, and to take strong root in the ground, stronger than many plants either you or I have seen. I should be very happy, when convenient for you, to have a conversation with you on the layering and pruning. I am, Mr. Monteath, your most obedient and humble servant,

ROBERT M'FARLAN.

It is plain that, by this method of planting, the face of bare rocks and barren places may be carried up to a very considerable distance : every species of hard wood trees will layer in the manner described, the beach, hornbeam, and laburnum only excepted. The profits to be gained by this method of filling up blanks in natural woods, or converting them wholly into oak wood, lands covered with birch, alder, and hazle, no pen can properly describe ; suffice it to say, it is a method the most effectual, most permanent, and the most lucrative, (as the layer shoots will produce nearly as much bark when the wood comes of age for cutting, as those from the

natural stool,) and of all methods the most cheap and easy, particularly with the oak.

But let us try to make a new plantation in this way, and suppose we are to plant from one to a thousand acres : for example, take one acre ; suppose we are to plant it with oaks, &c. at forty feet distant, plant from plant ; this requires, on a Scotch acre, only thirty-four, and on an English acre, twenty-seven plants ; suppose the soil extremely poor, the surface rough, and covered with whins, broom, heath, or what you will ; now, it will cost very little expense and workmanship to be particular in preparing the ground, even adding a little manure, or burning, &c. as has been already recommended, and carefully putting in twenty-seven or thirty-four plants in each acre, and cutting them over in the way formerly described, one man will plant two acres, with ease, in one day, nay, he may do four acres in one day. In good soil, the plants are to be put in strong, as formerly mentioned, and every year's growth

cut over till the fifth year, when each of them will have swollen at the root from one to one and a half inch in diameter, and will, for the most part, by often cutting, have sent out four shoots; these must now grow till the end of the sixth year's growth, when, if care has been taken in cutting, and proper attention paid to them, they will be from six to eight feet high; they are then to be layered out on all sides; by twice layering, in the manner before described, they will, in eight years, fill up the whole ground, except the diagonal corners, with plants at eight feet distant, plant from plant, (the distances required for a natural wood,) and in four years more, say twelve years, the whole ground can be covered with plants, or rather trees, of from four to twelve feet high. Should some of them, which may be the case, only send out two or three shoots, they can easily be supplied by layering the side shoots,—say the collateral shoots from the layer, which is easily understood, and which will answer equally

well,—in the same way filling up the diagonal corners with the collateral shoots. Thus, it will be allowed, that a plantation can be reared more effectually, and much sooner brought into a plantation of timber trees, by planting only twenty-seven or thirty-four trees on each acre, than by planting the whole. If the land is extremely poor, and requires a new soil totally to be made, plant in larch firs at three feet distant, plant from plant, between the hard wood trees, which are planted at forty feet, and allow the larch firs to grow for eight or ten years, as described in planting moss lands, which will completely make the soil, when the firs may be cut out, the hard wood trees being cut over the year before cutting away the firs, which should be attended to, and the year after layer the young shoots from stools of the hard wood trees. By this age the roots of the hard wood trees will be about two inches in diameter, and there will be little fear of four shoots from each of them, if care is tak-

en to round the roots, when cut properly down to the ground.

I may here also observe, that the growths or shoots from the layers are not nearly so apt to be checked by whins, broom, heath, or any kind of rubbish, as the plants are, as their growth is far more rapid and strong ; and they will thrive in almost any soil, however poor ; with this difference, that if the soil is very poor, the layer must have a year or two's longer supply of nourishment from the old stool or root.

Besides the security and speed with which a plantation can be made and reared by layering, the saving of expense is a very great advantage. Suppose an acre of land to be planted with oaks, at eight feet distance, it will take 855 plants, which, at four shillings per hundred for such strong plants, will cost upwards of L.1, 14s. per acre ; whereas, by layering, it only costs one shilling and fourpence : here is a saving of L.1, 12s. 8d. each acre. The labour of planting and layer-

ing will be about the same ; while, in planting poor soils, fifty acres out of each hundred may require to be planted three times over. My reason for putting in three seeds or acorns on flat pieces of rock, when there is as much natural soil as will hold them, or even when soil can be laid on the crevices or chinks of the rock, will easily appear to the reader to be that they can be layered out in all directions. When trials of this method of planting are once made by those who have not yet attempted it, the benefits to be derived from it will be seen to be immense. Let it be here observed, that if the plantation is intended for trees to be reared up to maturity as a standing plantation of hard wood, some of the top layers may be used in filling up the diagonal corners, as in this case sixteen feet will do betwixt the trees, and save the thinning ; whereas, in a wood for coppices, they require to stand at eight feet. And when the tree root or stool is about six inches in diameter, when cut over, there will be such a

profusion of shoots, from whence the layers are to be taken, as that they can be layered out in all directions. As no language can properly describe this method of layering, so as to make it perfectly intelligible to those who may never have seen it practised, I have given a figure in another part of this work, representing the manner of doing it, which, I hope, will be so perfectly plain as to enable every one to do it with ease and safety.

In March 1822, I received a letter from a landed proprietor in Wales, which proves the fact and utility of layering to a demonstration, and makes many very useful remarks on the growth of different kinds of trees, and the manner of pruning his woods and plantations, consisting of nearly seven-teen hundred acres, which letter I would have inserted here at full length, but unfortunately the gentleman wrote it from London without adding his address; and knowing that the Right Honourable Lord Gwyder is a large proprietor in Wales, I sent his Lord-

ship the letter, in order to obtain the gentleman's address, that I might ask his permission to publish it ; his Lordship, in the multiplicity of business while in Scotland, had mislaid the letter ; should it cast up, however, before the work goes through the press, it will be added. In speaking of layering, he says, "The only effectual, cheap, easy, and profitable method of rearing underwood, as shelter for game, to prevent poaching, is from natural oak stools. I have (says he) often led out the young shoots, by pinning them down to the ground, to the extent of a great many yards, and that in all directions, completely covering the ground ; which affords far better shelter than hazel or any other kind of underwood ; and, in every fifteen or twenty years, such of the aspiring shoots as have attained more the form of a tree than underwood, I cut over for barking, which brings me in a very fair annual rent for my land ; and I have always, besides, a stock

of ornamental trees and underwood on the ground."

We may now advance a step farther, and notice shortly the shelter necessary for a plantation : this having been so luminously treated of by many authors, we may be very short upon it ; nothing, however, we may observe, is in general so prejudicial to trees as wind, which, by loosening the roots, and bending the tender branches, stunts them in their growth, keeps them always low and stubby, and sometimes even kills them altogether. For this reason, we always find that no situation is in general so favourable to the growth of trees in this country as the banks of rivers, and hollow dells between mountains, where, by the form of the ground, they are effectually secured from every storm, and sheltered from every tempestuous blast ; but, in more exposed situations, we are under the necessity of effecting by art what nature has denied. And if a plantation of firs, or any other trees, intended chiefly for orna-

ment or shelter, be planted on exposed situations, we must, if we would wish them to thrive, fall upon some method of protecting them when young and tender from the fury of tempestuous winds, otherwise they will inevitably languish, if not perish entirely. The best method for effecting this purpose is to make the plantation of considerable extent where the exposure is bleak, and to plant the trees at first extremely close together—say not more than thirty inches, or at most three feet distant, plant from plant, so that they may mutually shelter one another from the violence of the wind; and as the trees advance so as to require a greater space, let the weakest trees be gradually taken away to give room for those which are in a more thriving condition. And here I would advise that the thinning commence when they have attained a height of five feet, and be gradually carried on year after year, till the trees arrive at a height of from ten to twelve feet, when the thinning should be

finished, and the trees, particularly if firs, should be left at the distance they are to stand to be reared up. The manner of thinning should be particularly attended to, as the plantation being planted so thick, if allowed to stand long without being thinned, a mortification of the roots not only often but almost always takes place; and the whole plantation not only suffers in health and prosperity, and becomes stunted in growth, but there is no possibility of thinning it afterwards to keep a proper crop of trees upon the ground. In all plantations on exposed situations of this kind, I would recommend them to be margined with a double or triple row of spruce firs, planted in a triangular form, and two of those nearest the outside may be headed down at twelve feet from the ground, which will be found particularly well calculated for skreen or shelter, either for the interior of the plantation, or for the lands on the outside, which, if pasture land, will afford excellent shelter for live stock, whether sheep

or cattle, as the firs thus treated throw out lateral branches and feather to the ground. Allow me here to observe, that, in making a plantation in such situations for ornament, where a variety of hard-wood trees is required, the kinds already referred to will grow, and can be reared by frequent cutting without any shelter whatever. And here I may also take occasion to observe, that in countries where the indefatigable Sir John Sinclair and others have reckoned it impossible to rear woods or plantations, or trees of any kind, I can boldly aver, that in the most exposed situation, even to the east, and north-east winds, by frequent cutting, the oak, Spanish chesnut, the Scotch elm, ash, plane, and birch, may be reared either for cutting over as coppice, which is the most profitable, or for ornament, by allowing three shoots at least to be reared up from each stool after the stool or root has attained a diameter of from ten to twelve inches by frequent cuttings. Ten thousand proofs of this kind

stand on almost all the western coasts of Scotland, particularly in Argyleshire, where, in all the arms of the sea called lochs, the salt water in many places, when the tide is in, not only washes the roots of fine healthy thriving natural oak stools, but in gusts of wind, which are frequent, throws the spray amongst them for acres, yet these are not the least hurt by it. Let it be here carefully noticed, that thousands of the oak stools I here refer to are, on the shores of different arms of the sea, exposed to the north and north-east blasts, and to these only, being screened from the south and south-west by the hills above ; and these stools, after being cut over for several years, are equally healthy and productive. Let none, therefore, presume to aver, as has been done by many authors, that the sea air is prejudicial to the growth of trees. What says a great author on this subject ?—" Every plantation," says he, "on the western coast, will be most prosperous when sheltered from the south-west." But

every one who has travelled these coasts, either by sea or land, will say this is false, as these, exposed to the south-west, are for the most part most prosperous. I also boldly aver, that if the method I have laid down, and been recommending, were put into practice in a proper manner, there would be no difficulty in rearing oak woods and plantations all along the north coasts. In all Aberdeenshire and east of Fife, for example, there are several natural oak woods, equally good bark as the West Highlands, and equally productive on different estates in Forfarshire, not far from Arbroath, where the east wind beats upon them from the German Ocean. I must here observe, once for all, that there is scarcely any soil, climate, or situation, however exposed to any wind that blows in this country, that the hardy, venerable, and valuable oak will not grow and thrive in, if proper attention is paid to the cutting and dressing of its roots. Another very important and particular ad-

vantage to be derived from frequent cutting, particularly the oak, is, that they will grow and thrive in the most exposed situations without any shelter whatever ; and this does away entirely with the idea of planting nurses among oaks, when planted for natural or coppice woods, as by cutting, they soon gain the ascendancy over every plant, so that if intended for an oak wood, the whole ground should be filled up at once with oaks, without nurses, even in the most exposed places. This is plain to a demonstration from many places in Scotland, particularly in Argyleshire, where oaks on the very tops of hills from 500 to 1000 feet above the level of the sea, are equally healthy, produce equally good bark, and are nearly equally productive with those in the vales, although they are exposed to every gale that blows.

We may next shortly notice the manner in which belts and stripes of planting, chiefly intended for ornament, warmth, and shelter, should be conducted ; and here I must se-

verely censure my predecessors for advising and laying off belts and stripes of this kind so narrow. We can scarcely travel a few miles in any part of the country, without seeing melancholy proofs of this. On every hand, there is scarcely a belt or stripe of planting we pass, of thirty years old and upwards, but which upon inspection will be found to be either in a rapid state of decay, and in many places extirpated, or presenting great blanks and gaps here and there, through the whole, and by no means serving the purpose they were intended for. This injudicious method of grouping up plantations of this kind, which will only make a show for a few years at first, but never can be permanent, should for the future be carefully avoided.

It is well known that plantations of this kind afford excellent shelter for live stock, when the fields around them are in pasture, and also for the crops; and, when they are judiciously reared, beautify not only an estate, but the whole country. The method

I would propose for rearing belts and stripes of plantations, intended for permanency, shelter, and ornament, is the following. In the first place, none of these should be less than ninety feet wide, particularly when the country is bare, and the ground cold. In other cases, seventy-five feet may do. Having laid off the belt to the width intended, plant a triangular row of spruce and silver firs alternately on the outsides ; or the whole may be spruce, if the soil be found more suitable for them ; and, if much shelter is wanted, particularly for live stock, these may be headed down, as formerly directed, at twelve or fifteen feet high. When ornament is the chief object, allow them to grow, without heading down ; but as the silvers will live to the same age with the spruce, and will thrive on almost the same soil, wet only excepted, (on which the spruce will be seen to thrive better than any of the fir tribes,) I would recommend an equal number of silver firs, as these grow to a large size, and are very ornamental trees,

and give variety to the skirts of the plantation. In the interior, plant all kinds of hard wood, particularly those best suited to the soil, and if a soil, where every kind will grow, I would recommend the oak, Spanish chesnut, Scotch elm, beech, and plane, as these will grow to a large size, and live to a great age. The manner of planting these trees, in all such belts or stripes, should be in angular lines. (See a figure in another part of this work, showing distinctly the manner of planting and thinning these belts.) But here it may be proper to observe, that the plants should be put in at first at four feet distant, plant from plant, and the outside row four feet from the fence, and thin out for the first time to eight feet, and the second time to sixteen feet; and, at these distances, the triangular rows of firs may stand, having room to spread out on one side, they will come to maturity at this distance, and their horizontal branches will meet

without hurting each other ; and, as these do not send out any large horizontal branches, like the oak, &c. they will not be injurious to the fields on either side, although, in crop, the hard wood trees in the interior may be thinned out to twenty-four feet ; but all this thinning must be performed before the trees exceed fifteen feet high. If underwood is to be propagated, as shelter for game, &c. the hard wood in the interior may be again thinned out to thirty-two feet distance, at which they may stand, since at this distance they will have room to become large ornamental trees. If shelter for game is required, I would advise this to be done in the manner formerly advised, by layering from the stools of oak and elm, as this will be profitable, by cutting the ascending shoots every twenty years for barking, as well as keeping a good supply of underwood for shelter, &c. If no shelter for game is required, let the whole underwood be oak, and rear it up from the oak stools, to cut every twenty-

four years as coppice for the bark ; and if the belts are kept fencible, that is, preserved from cattle and sheep, the oak coppice will be found to pay a fair annual rent for the land ; for this method of rearing oak underwood is as profitable as coppice for cutting and barking. (See the Section on Coppice Woods in another part of this work.) If neither underwood, as shelter for game, nor cutting for bark, is required, the belts may be laid open to cattle to pasture through them, in five or six years after the trees have got their last thinning. Observe that trees, in belts of this kind, should never be pruned after they are above four feet high. Nothing can be more disgusting to the eye, than to see trees like poles in plantations of this kind. As my chief design in this, as in the first edition, is to confine the volume entirely to a guide to the forester, confining myself to things mostly new, and being as concise as possible, I will wave saying any thing on the planting of land fit for carrying any kind of crop, or

any thing as to the planting of groups and clumps of ornamental plantations, as these have been luminously treated of by men of talent and ingenuity, who have trod the ground before me, and on which little new could be said.

As the inclosing of plantations is of such vast importance to the rearing of young woods and new plantations, we cannot pass it over without paying some attention to the subject of inclosing. In most parts of the country, we pass but comparatively few fields, and still fewer plantations, without seeing them exposed to the ravages of every animal. A mock ditch, a ragged hedge, or a broken wall, is, in too many instances, the doughty barrier to defend a valuable property from the inroads of cattle and sheep. Although inclosing, in the first instance, may properly be said to regard the proprietor or landlord, and it most generally does so in the first erection, yet, in general, it is an article of great concern to the farmer, as he is generally bound

to keep up the fences, and this is no inconsiderable charge. Indeed I have often known the clause as to fences being inserted in the leases of farms, to be a barrier in the way of landlords and tenants coming to an agreement as to their farms, after every thing else was agreed upon. Besides, many broils and law-suits have taken place between landlord and tenant as to their farms, and allowing their cattle to make inroads into plantations, &c. I have also often known the expense of inclosing deter a proprietor altogether from planting. Seeing such is the case, may I not be justified in proposing a method, by which inclosures may be effectually, permanently, and cheaply effected? And hence I must be allowed to introduce my portable wooden paling, (for a complete description of it, see the Figure and Plate representing it in its proper place in this volume,) which, in point of cheapness, durability, ease of erection, facility of repair, and elegance of structure, has not yet, I am bold to aver, been surpass-

ed or equalled in point of fencing, either for the interest of the landlord or tenant.

Draining is also very essential in planting when the lands are wet; and, if these are boggy or fenny lands, deep ditches must be cut to the bottom of the springs, and these must be of sufficient size to lodge the water, the same as recommended in moss lands; but, when the ground is of a rocky bottom, say on the sides of hills, &c. surface-draining will be sufficient, which may easily be performed with the plough. In cases where the plough cannot be got to operate, it must be performed with a spade. But the size of these can only be determined by the wetness and deepness of the soil. Still the whole of these drains in plantations may be left open, as open casts can do no harm in a plantation, when neither pasture nor cropping is required, as the plants are always to be put upon the selion; and if by layering, the layers can with ease be carried across the ditches or furrows.

SECTION II.

OF THINNING AND PRUNING TREES INTENDED TO BE
NURSED UP TO MATURITY.

THINNING and pruning trees is a subject that has been variously treated of by different authors. Some are for thinning, and pruning little or none; others are for pruning a great deal, and thinning little. It would be of the most essential advantage to plantations in general, if one rule could be laid down, and followed up throughout all the stages of plantations, with regard to their management and previous planting; for then it must, of course, follow, that however short-lived one manager of a plantation might be, it behoved his successor to follow up the same plan that he had begun, and so on in succession. Supposing you have a plantation to begin to look after, that has been planted with

all kinds of hard wood and firs, promiscuously, and where the plantation is designed chiefly for profit, not for ornament, and the firs having been planted with a view to nurse up as well as to shelter the hard wood, which is of great use, and is absolutely necessary in situations that are much exposed, when the plants, call them now trees, arrive at five or six feet high, for it is difficult to say at what age of the planting this ought to be done, as the growth will depend much upon the situation and soil; but at five or six feet high, go through the plantation, take away every fir tree that is in the smallest degree impeding, or likely to impede, the growth, or overtopping, or likely to overtop, any of the hard woods, taking care to leave a sufficiency of firs for shelter, and particularly on the outsides, or on those sides of the plantation most exposed, going through the plantations regularly every year, or every two years thereafter, and taking away gradually, as may be required, every fir tree, till, at the time

the hard wood trees arrive at the height of from twelve to fifteen feet, and the trees being of this height, thin out all the hard wood trees to a distance of ten feet tree from tree. Having done this part of the work gradually, till the trees are arrived at the height of fifteen feet, there should not be a single fir tree in all the plantation. It will be easily understood, that by the trees to be taken away, I mean nursing trees, or trees for training up the others, unless round the outside or places most exposed, where they may be of use to shelter the interior of the plantation. Supposing now, when your trees are at the height of fifteen feet, you have a plantation totally of hard wood, and that too of the most valuable kinds, such as oak, ash, elm, beech, Spanish chesnut, and plane. I mention these kinds, not only as the most valuable, but as they will, most generally all grow, thrive, and come to maturity on the same soil, the oak excepted, which will thrive

and grow to maturity among whinstone rock, where there is hardly any soil perceptible, which can be easily seen in the neighbourhood of Inverary, Argyleshire, and in many places of the Highlands of Scotland, and also on the face of the Ochil Hills, such as on the estates of Alva and Airthrey, where there can be seen large oaks growing almost out of solid rock. Here it will be necessary to leave the operations of thinning for a little, and say something of pruning, which is a work that ought to be done with great care and attention, as much of the growth, and also the shape, or rather the valuable purposes that a hard wood tree may be made to answer, depends on its being timeously and properly pruned. In this case the infallible proverb will hold good—"train up a youth in the way he should go, and when he is old he will not depart from it."—Trees, by proper management, when very young, can be brought to almost any shape.

The attention paid to a plantation, or individual trees, when young, always determines the future prosperity and value of the plantation or tree.

SECTION III.

OF PRUNING.

SUPPOSING you have a plantation, such as I have been describing, in the way of thinning, and supposing the plants to have been properly pruned before being put into the ground, which ought to be the case, and is now generally attended to, after the first thinning, which we suppose is done when the trees are from five to six feet high, go over the whole plantation again, and with a knife prune from off the ash, the beech, and the plane, all such stems and shoots as may seem

to be entwined with the main stem, making and keeping the main stems as clean as possible, and drawing them up to a very small top, so as not to injure the look of the tree ; still if it is a forest tree, and intended solely for profit, the value must be more regarded and attended to than the look of the tree. It is often necessary for the health of the tree, to have some branches on the main bole. Those to be left for this purpose, should be such as will do least injury to the trunk of the tree when it comes to be timber ; and here I would recommend to the forester, to be particular in his selection of those to be left, and be sure always that those left be branches that come out horizontally from the bole, and lop off those that rise perpendicularly up with the tree, as these have always a much greater swell at the trunk of the tree, and make far more coarse, and often blemished timber, than the branch growing in a direct line out from the tree. In order to assist branches, useful for the health of the tree, to

grow this way, tie a stone or weight to their top, and let it hang downwards, which will keep the root of the branch from growing to any large size with the trunk of the tree, and at the same time will serve the same purpose in pumping up the juices for the tree's nourishment ; whereas the branch that grows up, gathers what we term a cleft, and lodges wet, &c. betwixt the trunk and the branch, which always rots the bark, &c. and leaves a blemish in the timber when cut up. This is also the reason of what is called the *bark-gaws* in timber. We often see stripes of bark in boards of timber when cut up, which leaves a hole, and renders the board useless ; and this is the cause from which it proceeds ; and at this time, when any of these kinds of trees have two stems, each contending for the superiority, if it can possibly be done, without a material injury to the main stem, it ought to be lopped off, and carefully dressed up, as the value of these trees depends entirely on the cleanness, straightness, and

tallness of their boles or main trunks ; the value of the branches, even though they become measurable, especially of the beech and plane, being, in many places of this country, next to nothing—this is the time then to begin to train up the ash, the beech, and the plane, to be valuable trees. The value of the oak, the elm, and Spanish chesnut, depends a good deal on their being crooked, as they are all used in ship-building ; and indeed crooked elm is valuable for fillies or treads for coach and cart weels, and these trees require a different treatment in the way of pruning. If you have an oak, an elm, or chesnut, that has two stems, as it were, striving for the superiority, lop or prune off the straightest upright growing stem ; and if a tree that is not likely to be of such value be standing on that side, to which the stem left seems to incline to a horizontal position, take away the tree, and give it every chance of growing horizontally. At this time it will be necessary to take away a few of the per-

pendicular shoots off the horizontal branch ; and, indeed, if these branches, which is sometimes the case in these trees, seem to contend, take away most of them ; but if they do not, it is better at this time not to prune these trees over much, except the crooked shoots on the horizontal branch, till they arrive at the height of fifteen or even twenty feet. By this time it will be easily seen what kind of tree it is likely to form ; and, if it inclines to grow crooked, lighten a little the top of the tree, by taking off a few of the crooked branches on the straighter side, allowing all the branches to remain on the side to which the tree inclines to crook, to give it more weight, and to draw most of the sap or juice that way, and it will naturally incline more to the crook ; at the same time clearing away any other tree on the crooked side, that may be apt with the wind to whip the side of the tree to which it inclines to crook : also taking away such tree of less value as

may prevent it from spreading out to the one side more than to the other.

If the tree be considerably advanced, say to twenty feet or more, it should be observed that some of the shoots from the main branch of the tree (for such it may now be called) that was and is growing, and maintaining a horizontal position, if these shoots are rising perpendicularly from it, they ought, even at this advanced period, immediately to be taken off, leaving always most of those suckers, or small twigs, on the extremity of the branch, and on that part of it inclining downwards, to prove the means of drawing most of the sap to that part of the tree, and inclining it to grow still more horizontally. By carefully attending to these few hints, in the way of pruning and training up trees for crooks, experience, as it has taught me, will soon show you the benefit to be derived from it. I have myself tried the experiment with several oak trees, at about twelve feet high, that were a little inclined to crook, and that had also a

main branch inclined to a horizontal position. In the course of less than twenty years I had the pleasure of seeing some of these very trees grow so very crooked, that the branch would work in with the main stem or body of the tree, to a complete knee, or square, which is the most valuable of all trees. And as ten trees of crooked oak is required for one straight one, it is of the most essential consequence to have crooked oak trees ; and, besides, an oak tree properly crooked, that will answer for a large knee—say the main branch to be fit to work in with the body or trunk of the tree without much waste of wood, and at the same time, to have a cleanness and evenness of contexture,—such a tree is more than treble in value the same number of straight trees ; and, indeed, knees of oak are extremely scarce and difficult to be got. Elm and chesnut are not so much used for knees as for flooring and foot-hook timbers of a ship, which are also very valuable. By carefully attending to these hints a

great many valuable crooks may be obtained. But the oak is the most valuable, and the forester would do well to attend in particular to make these grow crooked when they are to be reared for ship-building.

Tulliallan, 12th Feb. 1824.

SIR,—In your first edition of the Forester's Guide, the system you describe for pruning neglected plantations, and the mode of training young trees intended for ship-building, are, in my opinion, concisely done. The latter of which I have tried, and as yet have every reason to believe the mode effectual, provided periodical attention is paid to the point of the horizontal leader, cutting off any perpendicular shoots of the same year's growth, as the principal one growing in the horizontal direction. Also until the unnatural shoots, occasioned from the effect of pruning, are extirpated the bole, which process can be accomplished in three or four years subsequent to each operation of pruning; an instance of which I personally performed in summer and year 1821, upon the estate of Meiklour, (the property of the Right Honourable Lady Keith.) I pruned a considerable number of oak trees, which were then twelve years old, among which were a number that their tops were growing in a horizontal direction of different angles and curves, and were pruned according to your system. The same year, in autumn, I scraped off the unnatural shoots upon the bole. About the middle of August 1822, the same process was repeated, which was easily accomplished, as there were not one-third of these shoots which were the preceding year. And towards the latter end of August 1823, scarcely one of these shoots were to be seen upon the trees; any which were seemed extremely weak, and their points de-

cayed. Also in all kinds of profitable pruning, have found that this system is the only auxiliary yet in practice, to attain tall clean boles, and wholesome timber.

The expense of scraping off these unnatural shoots (so high as is intended to extend the bole next operation) is a mere trifle, as a man can with ease go over several hundreds per day, provided the operation is begun in time, and afterwards regularly attended to, before they are internally united with the present year's growth; and, permit me to say, attention to that one very particular and important object, is the only and effectual alternative to produce sound and unblemished timber, to attain such must be a chief point in forestry, and no doubt the sole design of extensive planting; but until a mode of this kind, or some other homogeneous is properly established, it is my opinion the owners of wood-land cannot enjoy the value of their estates in the superlative degree.

Pruning young trees, which have been regularly trained from infancy, I have not the smallest hesitation to displace the largest exuberant branches, provided an adequate number of smaller branches are left to produce an abundance of leaves sufficient to concoct their juice. However, the exact number of branches to be left, no pen can with propriety determine, nor even a plate truly represent, farther than the position each lateral should be placed upon the bole, when trees are found that will allow the proper system being carried into effect. But as instances of this nature so seldom occur in practice, without trees have been regularly trained from infancy, in that case, I presume, that the only alternative for those who are unacquainted with the proportion of lateral branches requisite for the future health of trees, should strenuously pay attention to the modes adopted by those who are famed in the profession, *but only those* who can by their works produce sound and unblemished timber.

Early pruning is recommended by all recent writers, with a view to get finished, in a certain degree, as soon as possible; the same principle I do concur with, as the amputating of large

branches must very much retard the growth as well as injure the future health of young vigorous growing trees, if the wounds are above one inch diameter ; and, at all events, pruning should be completely finished (except thinning the tops) before red wood is into the branches, for so soon as it is, the wound does not externally unite with the subsequent growths ; it matters not how much or how little red wood is, but, according to its size, the gangrene extends either in small or large wounds, and no aid can prevent its progress from reaching the heart. This may seem strange to some, but, after a moment's reflection, it may be easily accounted for, as the red wood does not externally unite, it must, and does internally decay, for so soon as a branch is cut when red wood is into it, the wonted nourishment does withdraw to give place for corruption. Also all species of trees, deciduous or evergreen, are liable to decay from the effect of injudicious pruning ; the oak and elm in particular, when large branches are amputated, after the trees have attained to the size which might be called timber. Neither does the white or sap wood unite after the trees are old, on account of the wound being so long exposed to the inclemency of the weather, and having lost the strong cementing juice of a vigorous sapling.

What I have said regarding the system of training young trees in general, intended for timber, may suffice for the intelligent to make farther improvements, and a track for the yet illiterate to pursue ; in the hope of which, permit me an observation or two upon the system of pruning neglected plantations and trees. However, at present, to attempt a full detail upon that part of foresting, would be superfluous, as just reasons could be produced to fill the sheets of a quarto volume, in respect to the defect of timber occasioned by the various injudicious modes of pruning, &c. Therefore, I will solely confine myself at present to one very particular mode of pruning neglected plantations, above twenty years old, or after the trees are so large that the timber is useful. The general system too frequently practised, seems not altogether to effect the design of its origin ; and,

should I be asked the reason, the reply would be, because it does not produce sound, but blemished timber ; the verity of it none can contradict, as witnesses are in every plantation, and upon every tree without exception, where that most horrible practice of amputating large branches was allowed. I grant, that upon young healthy trees, these wounds may cover, (provided a great number are not cut off at once,) and to all external appearance, the timber perfectly sound, but such is not the case, and those who imagine so, are only deceiving themselves ; to prove the verity of it, uncover a wound, the dismal catastrophe will appear. Among the many of these illiterate practices, so prevalent, I shall only point out two instances which occurred upon estates adjoining the one formerly mentioned. In the year 1815 a great number of hedge-row trees were pruned, (principally oak, elm, and ash,) for the express purpose of obtaining tall clean boles, the wounds were in size from three to nine inches diameter, and at this time not one of these wounds is healed over, also what is worse, the boles are completely covered over with unnatural wood or shoots, the top of the trees are in a languishing state, being robbed of their due. In the year 1822 a number of them were felled, which I examined, and those which had large wounds scarcely a sound foot was, excepting the lower part of the bole, where no branches were pruned off. Another instance I remember of being done in the year 1819 ; the trees were of the same kinds, and pruned like long poles, with a mop on their tops, and are, in every respect, fast approaching the state of the former.

Having seen, and by experience felt the evil resulting from such injudicious management, I have tried a system of pruning which appeareth to be better adapted for reclaiming neglected plantations or trees, than any one system yet put into practice, or ever can, while the system of amputating large branches exists.

1st, Prune out the small exuberant branches at the top of the tree, but so as not to injure its natural figure, if in case it is not

top-heavy ; but on no pretence cut any branch above one inch diameter, excepting dead ones, which the tree must be completely cleaned of.

2d, After the top is lightened, prune all the remaining branches upon the tree in every respect the same as pruning young trees of the same size and species ; and be particular to prune off all small unnatural twigs, either upon the bole or branches, so far as they are pruned out, or can reach ; and, to finish the tree completely, all moss should be scraped off, which can be done for a mere trifle ; an active boy can do the operation well, and as fast as one man can prune.

Pruning, according to this method, will not lengthen the bole farther than nature has determined ; however, the reclaiming of neglected plantations or trees, according to this method, will always produce sound timber, which sells at all times at full value.

I am,

Sir,

Your most obedient Servant,

ALEX. BLACKHALL.

TO MR. R. MONTEATH,
Wood-Surveyor, Stirling.

The above letter is quite to the point as to pruning, which I trust is apology enough for its insertion.

To return to ash, beech, and plane,—the same method as is used in pruning them at five feet high, ought to be pursued, and carried on until the trees shall have arrived at

from twenty to thirty feet high ; taking care to train them up to grow as clean, straight, tall, and with as few branches, in their main trunks, as they possibly can be reared with ; as their value, either for machinery or husbandry, depends on their being straight and free from knots, and beech in particular for ships' keels and planks ; therefore there should be no pruning allowed on trees after they are from fifteen to twenty feet high. Indeed the sooner the operation of pruning is finished the better, because when done (though sometimes necessary) when the trees are arrived at an advanced age, and even done in the best and most careful manner possible, it not only has a tendency to injure the growth of the tree, but it also leaves blemishes in it, which, though apparently healed up, and the tree looks well, and has not the least appearance of any blemish, when cut up by the tradesman after, shows blemishes, altogether unforeseen when the tree was growing ; and entirely owing to bad or

late pruning, which renders the timber of such a tree almost useless. The pruning should, therefore, be done when the tree is young, and taken close in to the interior of the bark, with a very sharp instrument ; and taking particular care not to hurt or injure any of the bark but where the branch is cut off.

If a large branch requires to be taken off any tree, which may be the case if the branch be dead ; supposing this, it is better to take off the branch rather than to let it rot off, for then it generally leaves a wound in which the water lodges ; and consequently leaves a blemish in the trunk of the tree. In taking it off, saw it about eight or ten inches from the trunk ; sawing it first so far through from the under side, and in sawing it from above, the weight of the branch will cause it to give way before it is quite cut through, without any risk of injury to the tree by splitting. On the other hand, if at first cut close to the trunk it would split down, at

any rate it would tear the bark from the body of the tree, and of course very much injure it. Besides, if cut close to the tree, at first the weight of the branch, although it was so far cut below to save splitting, would leave small rents, which the heat of the sun would open, so as to receive water, and consequently very materially injure the tree.

In the event of cutting the branch twice, the second cutting of it prevents all risk, and when cut off with the saw, ought to be dressed up with a sharp instrument to prevent water from lodging in it; and a little balsam, such as recommended in the section on the diseases of trees in this work, spread over it, which greatly prevents either the sun or the wet from proving injurious to it. But, unless in cases of a very particular nature, large branches, as I have said before, should not be cut off.

We shall leave the subject of pruning, and return to thinning, as in page 76. Suppose

the plantation is totally of hard woods, of above fifteen feet high, and after the operation of pruning, for at least one year, of such as required pruning, was finished, it will be proper to thin them gradually year after year, and to take away in a regular manner those trees more especially that are not thriving, and are the most unlikely to become valuable; and, at the same time, to endeavour to keep the remaining trees as regular as possible, in order to have a complete crop upon the ground. This mode of thinning, or weeding, must be carefully attended to, so as not to make gaps or blanks in the planting; and particularly at such places of the plantation as are much exposed, keep the trees there always a little closer or thicker on the ground.

The manager or forester need not be told, that the thinnings will now be coming to be of some value; and if to be sold in whatever way, they ought always to be cut down either by or under the constant attendance of the

person to whom the care of the plantation is entrusted ; and he ought to take particular care that, in cutting the trees to be taken out, he does not allow them even so much as to fall on those intended to stand, because although little or no damage may be done apparently to the standing tree, yet it has a tendency to loose it at the root, and thereby hurt its growth. Thus, by carrying on the operation of thinning in a gradual manner, it will now and then, as the thinnings are becoming more and more valuable, be bringing in a considerable sum to the proprietor ; and this operation must be carried on as need requires, till the trees are from thirty to forty years old, and at this time the plantation should be brought to such a state of perfection, that the trees, (if ash, beech, or planetree,) should be at least from twenty to twenty-five feet from each other. If the plantation is to be converted into a grove of trees for ornament, and to be pastured under and amongst them, they should be thinned

out to stand at a distance of thirty-four feet, tree from tree ; but if oaks, elms, or chesnuts, being crooked or large topped trees, from twenty-five to thirty-four feet from each other, according as the tops of the trees are in extent ; so the distances must be regulated by the tops of the trees, in order to keep them from hurting one another, and not at all by the roots, supposing them forest trees to be reared chiefly for value. Having proceeded so far in thinning or weeding the number of trees now remaining on the grounds, they may be allowed to remain till they are 60 years old, and then thinned out to 35 feet distant. It may be said that there are still too many for a crop, that is to say, more than the ground will carry ; but it may be observed, that trees are liable to many accidents, both by wind, lightning, &c. &c. so that making this allowance, it will be necessary to keep them a little plentiful, rather than have them too much thinned, and have thereby but a scanty crop. It will be here

observed, that I have, all along, been considering a plantation planted chiefly for profit, not for ornament, and the planter, or at least the person who began to train it up, when the trees were five or six feet high, still continued to train up, or at least the same rules are still to be followed up. Allow me to say, that the profits and advantages from a plantation trained up in this way will be immense, as is shown in a following part of this book.

SECTION IV.

OF NEGLECTED PLANTATIONS.

It is now necessary that something should be said of the thinning, pruning, &c. of neglected plantations, of which there are, I am sorry to say, a great many in this country, ne-

glected either from a want of duly considering the profits that may be derived from them, if even yet attended to, or from an opinion that there must be a good deal of money laid out in the first instance, and that the thinnings, even for some years, will not pay the expenses. It is a pity there should be any obstacle in the way, and I hope, through time, they will all be removed.

Supposing now, you have a plantation to begin to, that has been planted perhaps twenty or thirty years ago, less or more, and supposing an axe never had been used, or any thing done to it in the way of training up, it matters not what has been the design, whether it was intended to be all hard wood, all firs, or part of all kinds, you must now consider the crop that is on the ground, or what is likely to be a crop, and go over it, and carefully mark out for standing, to the best of your judgment. And here much caution is to be used in marking those trees, whether hard wood or firs, that are most likely to arrive at

maturity ; and having done so, immediately set about thinning out a very few of the worst of all kinds as they come in the way ; at the same time pruning, as you go along, those hard wood trees which you intend to stand.

If the planting is very thick and close, you must not thin it above half what you are convinced it requires at first, because if the air is suddenly allowed too free admission, it will rather injure than benefit the planting, by stunting the trees in their growth, &c. ; and more particularly so, if the planting be much exposed. I knew a plantation on the estate of Dunnipace, in Stirlingshire, that had been over thinned, after it had attained a considerable age. The reader will be pleased to observe, that the plantation referred to was not badly thinned, for want of skill, as the whole was intended to be cut in course, and the worst trees were taken always first away ; still it shows the impropriety of injudiciously thinning a neglected fir plantation,

before it could be planted up again. In the winter of 1814 the wind struck in upon it, and in one night rooted up almost every tree, leaving only about fifty or sixty standing, on an extent of nearly five acres of ground. As the trees were from eighteen to thirty feet in height, the desolation was tremendous, and even the expense of clearing the ground was very great, in consequence of the large size of the roots turned up with the trees. I could mention many other cases of a similar nature that have come under my own observation.

In a plantation, therefore, of this kind, I would recommend pruning rather than thinning, so that after having given it a very scanty thinning, let it be all properly pruned; and in this case great care should be taken not to cut all the branches or shoots from off the trunk or body of the tree too much, but to thin or lighten the tops very considerably, so as they may not be left at all top heavy, which is a great mean of

making them not only easily blown down, but also easily shaken with the wind, so that although not blown entirely down, they are apt to lose their growth, if not altogether, for at least several years. In this case it will be seen, that thinning very sparingly at first, and gradually, as the trees begin to take new hold at the root, is necessary. After having pruned the whole in this way, not to destroy the look of the top of the tree, but as much as possible to lighten it, it should remain in this state for at least two if not three years, when the operation of thinning ought to commence, and be carried on gradually till finished, in the same manner as described in Section II. page 78, but with more caution, taking care to give those that you intend to train up to maturity, always time to fix at the root, so as to resist the effects of high winds, at least in large numbers, for it is almost impossible but some will, in a plantation of this kind, be blown down. Endeavour always to keep the ground as regularly

full as possible of the most valuable trees, particularly when you have a choice. At all events, endeavour to train up such trees as you have on the ground, that you think in any degree thriving, and by no means cut out and make great blanks, as some have suggested to be done, and say they replace them with new or young plants. In such a case I would apply the old Scotch proverb—"You will lose bundles gathering straws;" for experience has told me, that for ninety-nine times out of a hundred, you will lose your plants and the expense of cutting, &c.

SECTION V.

OF FIR PLANTATIONS.

As to plantations consisting wholly of fir, a considerable difference of opinion has and

does exist. Some, and indeed a great many are not for thinning at all; hence they say firs always thin themselves, because, when too close pressed, those that are most thriving soon overtop those that are not so thriving, and by this means they soon kill them, so that a plantation composed entirely of firs, does by degrees thin itself, and should be allowed to do so. Others again say, that fir plantations should be both thinned and pruned in the same manner as other plantations. My own opinion, however, is, that a plantation composed entirely of firs, and planted with a view to and for profit, should be regularly thinned, though not to such a degree as hard wood, because the purpose for which fir is applied, requires the trees to be perfectly straight, and as clean and as free from knots as possible; and as their value chiefly depends on this, it certainly is, and ought to be, the chief object in training them up for that purpose. Therefore, when trees in a fir plantation arrive at the height of five or

six feet, they should be regularly thinned out by degrees, year after year, till they arrive at the height of between twenty and thirty feet ; and at this time the plantation ought to have been gradually so thinned, that the trees shall not stand nearer than twenty feet from each other, if common Scotch spruce or silver firs ; and, having a fir plantation thinned to this distance, when the trees are from twenty to thirty feet high, it should never be touched in the way of thinning, but left to itself. At this distance, there is plenty of room for them to grow large, straight, and tall, the only properties that can be possessed by a common Scotch spruce or silver fir.

If the plantation consists totally of larch firs, they ought to be kept a little closer, particularly on the outskirts of the plantation, as they require more shelter than the common Scotch firs ; or even where there is a mixture, if much thinned, the larch grows very crooked, which renders it of less value, unless when it is to be used in ship-building, which

has not yet become general, though it is a kind of wood well suited for that purpose. A plantation wholly of larch firs should not be thinned out to more than fifteen feet tree from tree, if they are to be reared up to maturity.

Pruning of Trees.

No species of fir tree whatever should be pruned, because in pruning they bleed so much that it very materially injures the growth of the tree, when the branch taken off is in a thriving state. I have often known fir trees, after being pruned, stand still, and not grow one inch for five or six years; so that I consider the pruning of healthy branches of fir trees as injurious to their growth, and in my opinion it should never be done. But when a branch on any kind of tree, but more especially a fir tree, begins to decay or rot, it should immediately be taken off close to the bole of the tree, as formerly advised, be-

cause if permitted to rot off, though it be only a small branch of a fir tree, it always leaves a hole in the trunk where it comes off from it. And although this hole soon fills up, and does not in the fir, as it may in a hard wood tree, lodge water, so as to injure the main body of the tree, yet it always leaves a black mark ; which, if it ever grows into a knot, will be seen after the tree has been cut down and sawn into boards. And a knot in a fir tree, from a branch that has been allowed to rot off, is always loose when it comes into the hands of the tradesman; in the working, the knot comes out, and leaves a hole in the board, so that it frequently happens, that after having undergone a very considerable degree of workmanship, it is rendered useless ; whereas, if the branch is pruned off close to the bole of the tree before it be quite rotten, if it does leave a knot in the tree (but frequently, if the tree stands a considerable time after, it does not,) it will always be a firm knot, and will by no means come out,

even though sawn out into boards half an inch in thickness; so that to cut off carefully the dead branches from the fir tree is of very material service to them in point of value; but do not cut off living healthy branches of any kind. *

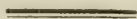
Neglected Fir Plantations.

If a fir plantation has been neglected till it has arrived at twenty or thirty, or even

* Here I beg leave to mention again the gentleman's letter from Wales; he seems to have given the first edition of the Forester's Guide a review; and when he writes, he says, "Your little manual is just now before me." And the only place he differs from me, so far as I can recollect his own words, is, "You are quite wrong as to not pruning of fir trees. I have pruned fir trees of every description in the plantations on my estate; and I find the trees much more healthy, and thrive better, than when left to nature's pruning. The rosin that emits from the wound acts as a salve, and soon heals it up; and I have no doubt but the timber will be found perfectly sound when it comes into the hands of the workman, provided always this is done when the trees are young. I take especial care to see that all my trees are pruned with the hand-knife; and, when out of that reach, I never allow any pruning."

forty years of age, if the soil be good, and the trees have taken a good hold of the earth, it will be of very great service to give it a little thinning, but to do it in a very sparing manner; but still, it would be beneficial to do it a little, and especially in those places where the plantation is most sheltered. But if the soil be rocky, and the roots running mostly on the surface, (which is often the case with the larch fir in particular,) it ought hardly to be thinned at all; and, in this case, it may be advisable to allow a fir plantation to thin itself, if it cannot be done without the risk of trees not only being blown down, but loosened at the root by the wind, which is almost as injurious to the trees as being completely blown down. But in every case where it can be done with safety, plantations of fir, as well as of hard wood, should be thinned; because, if properly attended to, the trees will make more progress in two years the one way, than in three the other. The thinnings also will pay much more than the

expenses, and ultimately the crop on the ground will be made to thrive much better, and be of more value.



SECTION VI.

OF NATURAL OAK WOOD.

IN the section on valuing natural oak woods, the profits to be derived from them are particularly pointed out. All that is necessary to be said here in entering upon the subject, in that respect, is, that no kind of cropping whatever will pay the proprietor better than a crop of natural oak coppice wood, to cut every twenty or twenty-four years. A crop of wheat is the only thing that is said to pay the agriculturist, extravagantly, so to speak, and this is said to be so abundant in some

places, when the land is very good and well manured, as to produce sixteen bolls an acre ; and this, supposing the average price at two pounds per boll, is no less than thirty-two pounds per acre. But it will be observed, there is to be deducted from this the expense of seed, labour, and manure, which will cost at least seven pounds per acre ; and the ground or field, however good, before it can carry a crop of wheat to this, or nearly to this degree, must be a year at least in fallow, then you have only L.32 for two years crop, which brings it down to L.16 annually ; we must deduct the L.7 off the L.32, which brings it down to L.25, being only L.12, 10s. ; from which we must also deduct the labouring of the fallow, which we may only call 10s. ; again, for cutting down the crop, gathering it in, thrashing, and taking to the market, will bring it down to about L.10 per acre for the very best crop that can be produced by the farmer ; and even this produce can only be realized once in four or five years, according

to the rotation of cropping the same field. Besides, when I speak of sixteen bolls the acre, it will be seen that I am far above the average of wheat crops in general, even on the best of land ; besides, these crops are liable to many failures and misgivings ; and it may be said that the best of land, one year's crop with another, will not average more than twelve bolls an acre. This, on the same data, will bring the annual rent or produce down to about seven pounds per acre, even laying aside all the risks of mis-given crops. But here I am going out of my road, and entering upon a subject I am not a judge of. To return, land that will by no means carry wheat or any other kind of crop, will carry natural oak wood ; and if it be land, however poor the soil, if free of bare rocks and marshes, it will pay, as will be seen in the sequel, at the rate of ten pounds per acre and upwards of annual rent, without any seed, manure, and, I may add, annual labour, except keeping good fences, and once in twen-

ty or twenty-four years a little thinning of the stools the year after being cut. Nothing can be more profitable, and yield a more steady and sure return to a proprietor than oak natural wood, particularly when the wood is in the vicinity of a bark market or water carriage; and indeed the way and manner that bark is now manufactured, (as is described in another part of this work,) it is easily conveyed, being chopped small in the wood, and put into bags; and good roads being now general throughout all the kingdom, a good horse will take fully a ton on a cart, so that the carriage even from an estate thirty or forty miles inland is but trifling, and will not, even at this distance, take above five or six shillings off the rent of an acre, more than those estates holding a local situation to the market. In planting a field for a natural oak wood, whether in filling up the ground by putting in plants, or by layering, they must be reared to fill up the ground exactly at eight feet distant tree from tree.

This gives them just room enough to spread out to produce a sufficiency of crop, and that without overburdening the ground. Besides, if there be more room betwixt the trees or stools, when they come to be cut, the young shoots spread out too much in a horizontal position, and the timber of the coppice stools grows so crooked, that at this age it is fit for nothing but fire-wood or charcoal; whereas, if the shoots grow straight, (and when confined to eight feet, they are much more readily reared straight than when they have more room,) the timber of the straight shoots is much more valuable for wheel spokes, and many other purposes, at the age of twenty-four years.

I would here fix the cutting of all natural oak wood at twenty-four years, as the bark may be reckoned at its prime at this age. And I would here recommend it to every proprietor that has even but one hundred acres of natural oak, that he divide it into twenty-four hags, or yearly cuttings, which will be

rather more than four acres to each hag, and sell or cut a hag yearly. This will produce an annual income; and in almost all places of the country there are tan works that consume considerable quantities of bark, and in this manner they will not only have a sure and regular yearly income from their woods, but will also afford a regular supply; so that the price will be more steady than by cutting large hags in one season, and as it were glutting the market, so as to produce a fall in the price. Do not understand me as confining the proprietor to 100 acres of coppice wood only. Far be it from me; the more the better for him. What I mean is, that every proprietor that has 100 acres and upwards, should divide these into twenty-four hags or yearly cuttings. Although he should have from 100 to 5000 acres, let them be divided as equally as possible into twenty-four hags, according to their produce, and not exactly according to the number of acres; for if it is rocky land, and where there must be more

blank ground in one place than another that cannot be covered with wood, one acre of some of the hags may produce more than three of others, and so on ; but always divide them equally according to what they will produce. There are some proprietors in this country, that have from four to seven thousand pounds annually from the produce of their natural oak woods. As has been said before, there is not the least occasion for shelter to a natural oak wood, unless in the entry to a den, where the wind is accustomed to break in upon it, when blowing from certain quarters, with unaccustomed violence. In this case, it will be proper to have a belt of planting of at least sixty feet wide, altogether of firs, and these always kept very close, to shelter that part of the coppice thus exposed ; but after having been once cut, there is no need of shelter in almost any situation however exposed.

If the spot of land intended for a coppice plantation, have some marshy places in it,

that will not carry oaks, let them be planted with ash, as ash will thrive in wet situations, where oak will not, and ash will grow naturally, or from the old stock, in a similar manner with oak, and is also very valuable at the same age ; but if it be found too wet for ash, let it be planted with birch, as it answers to cut along with the oak, and is of considerable value, as the bark sells at half the price of the oak bark.

None of the oak trees, in a plantation newly formed, and coming forward, intended entirely for a natural oak, or coppice wood, ought to be pruned before the first cutting, as, in proportion to the branches they bear, will the quantity of the bark be increased ; so that all should be allowed to grow on them, excepting dead branches, which should always be pruned off, as the very drop from them is injurious to the healthy ones ; and if any of the oak plants, or layers, have given way, the ground ought, as soon as it is observed, to be filled up at all ages of the cop-

pice, keeping the ground, as aforesaid, always full ; although they should not come forward to be as good trees as the others at the time of cutting, yet their roots will answer the same purpose when it comes to be cut for the new growth.

An oak wood so planted, and intended for a natural oak coppice wood, ought to be cut from the plant, the first cutting at the age of fifteen years, or at the longest not to exceed twenty years, because at this age the roots are of sufficient size to carry four or six shoots, and the natural growth is much more rapid, and at the same time more sure, and less liable to misgive than the plants. There will be, besides, on the ground three or four times the crop, after the first cutting, and there will be from even the second cutting, four times the quantity of bark, and three times the quantity of wood.

Natural oak woods cut the second, third, or any after time, from the natural stock, ought not to be cut sooner than twenty-four

years, nor later than thirty, because at this time the bark has arrived at a degree of perfection even more so than when allowed to remain after the age of thirty, for after that age it gathers a quantity of what is called cork, that is to say, the outside, or skin of the bark, becomes rough, and there grows in it a light substance resembling cork, which is not possessed of the principle of tanning.

Oak trees, at the age of twenty-four, or not exceeding thirty years, have as thick a rind or fleshy part of bark as when they arrive at the age of fifty. What may seem strange, but it will be found to be fact, and I make the assertion from personal experience, is that the bark from a natural stool of oak wood, at the age of twenty-four or thirty years, taking the timber measure, will produce, on weighing, as much as the same measurement of an oak tree at the age of fifty, taking an equal measurement of both trees, foot for foot, and the bark from these at twenty-four is supe-

rior in quality, and will bring a higher price.

Thus, after the age of twenty-four, or say thirty years, for the next twenty years the bark gives more to the corky part than to the rind or fleshy part, which is the most valuable. The tanners, or consumers of bark, will give L.1, 10s. and sometimes L.2 per ton more for the clean bark at the age of twenty-four, than for the bark which is covered with cork, although much thicker in appearance; in other words, they will give more for the bark of trees that are only twenty-four, or not exceeding thirty, than for the bark of those that are fifty years old and upwards.

For some years back, it has been customary to cut the natural oak woods at the age of twenty years. But I consider this as rather an early cutting, unless in cases where the woods have not been properly attended to, and where they ought to be cut down in

order to improve them. At twenty years old, the bark is not near so productive, nor is it so good in quality on the branches as at the age of twenty-four, as in most woods it will be found that the bark swells more both on the main stems and on the branches in one year after twenty, than it did in three years before that age ; and besides, the other four years growth adds a very great degree of more value to the timber. The rind, as it is called, or inner bark, which is that part of it that is only of use in tanning, will, on an average, be found to be no thicker on a tree at sixty years old, four feet above the root, than on the stem of a natural stool of oak at twenty-four years old, although the old tree has a proportion of cork, which only adds to its bulk and weight, without producing any more tanning substance.

SECTION VII.

OF CUTTING COPPICE, OR NATURAL OAK WOODS, FOR
THE GROWTH.

THE cutting of young natural oak woods, or dressing up the roots or stools, as they are commonly called, for the growth, is that part of a forester's duty, or whoever has the charge of natural woods, that demands the most particular attention ; since one stool, improperly cut or dressed, spoils the growth, not only for the next cutting, but loosens the root, and does such injury as it can never afterwards properly recover.

The particular manner in which stools should be cut and dressed up, in order that the new growth may spring up not only for one year, but that they may continue strong and vigorous during the age of the coppice, and to preserve the same stools in health and growth during succeeding cuttings, is a sub-

ject that has given rise to a variety of opinions, not only among foresters or managers of natural woods, but also among wood buyers and consumers, who always become the cutters when the woods are sold, which is most commonly done by the proprietors when growing. I have had occasion, for the last twenty-four years, to attend public or private sales of coppice or natural woods, in almost every shire in Scotland ; sometimes not fewer than ten or fifteen sales in a season, and on an average not less than seven ; and out of these, very few, I had almost said none, of the articles or conditions of sale regarding the cutting and dressing of the stools, &c. when read, gave general satisfaction, even to those who pretended to be judges.

It would prove mere waste of time, and would occupy more room than can be spared in a volume like this, intended for a pocket companion, to state the variety of opinions that have been advanced on this subject. The task would be by no means difficult, but

the reader would derive no advantage whatever from it.

I make no pretensions to laying down a perfect rule, I make no claims to perfection, but I hope and trust the rules which I shall lay down will give satisfaction to those who are in any degree competent judges, and such as, when put in practice, will recommend themselves.

Let us commence with a natural oak wood, to be cut for the first time from the plant. If the wood be sold to a merchant, he, very naturally, tries to make all the wood and bark he possibly can from it, and whenever he begins to cut, (this is quite customary,) he sends a person, generally a woman, before the cutters, to strip off part of the bark from around the root of the tree, from the ground proceeding upwards for two or three feet. This is commonly termed shaving or hosing the tree. Its design is chiefly to preserve any of the bark from being wasted or lost, when the axe is applied. In this operation,

however, a very destructive, and not unfrequently, a mortal blow is given to the root of the plant ; for it often happens that the person has no sooner got in the iron, or instrument intended for raising the bark, and has raised so much of it as to get a hold of it with the hand, than he or she tears it downwards, till it runs under the earth, and then it naturally separates the bark from the root of the tree before it breaks, and is the most effectual method that can be adopted for destroying the growth of the stool.

The person upon whom this duty ought to devolve, should be the most careful, as well as the steadiest in the employ ; and it would be an additional recommendation, if the person should have been accustomed to this operation.

This person ought to be furnished with an instrument with a sharp cutting edge ; the hand bill, as it is called, will answer this purpose ; and should receive instructions before commencing to strip the bark, to trample

down the long grass or foggage all round the root, and then, with the cutting edge of the instrument, to make a circular incision into the bark so deep as to reach the wood, at about an inch above the surface of the earth ; thus the bark, when taken off, will injure no part of that which is below the circular incision near the surface of the earth.

The root of the tree being thus prepared, the cutters ought to proceed to their part of the work, not with an axe however, if the tree should only be but six inches in diameter at the root, as is most generally recommended, but with a saw ; because in cutting with the axe, unless the root of the tree be so small in diameter as to be severed by one or two strokes at most, the axe loosens the root to such a degree, that it not only loses the present year's growth, but often fails altogether to grow. . Therefore, if the diameter of the root be six inches, or upwards, it should always be cut with a cross-cut saw ; entering the saw about half an inch above where the

circular incision has been made into the bark, if a small tree ; but if the tree be ten or twelve, or more inches in diameter, the saw ought to be entered two inches above it.

There are two advantages to be derived from cutting with the saw ;—it has no tendency to loosen the root of the tree, but also leaves it in such a condition as to be more easily and properly dressed ; it also saves a portion of the wood that would otherwise be destroyed by the axe ; and this is a great saving to the purchasers themselves, whatever purposes they should apply the wood to afterwards, whether for wheels, spokes, or otherwise. On no pretence should oaks of the sizes above mentioned be cut with an axe, but always with a saw. Having cut through the tree with a saw, take a sharp adz, and round the edges of the stool or root, going close down to the surface of the earth, taking with the adz both bark and wood, sloping it up towards the centre of the stool,

taking particular care always that the bark and wood both slope alike, as if they formed one solid body,—being sure always that the bark be not detached or loosed from the root.

It is of little importance how far up the slice is taken off, or whether the root be rounded close into the centre, or drawn up to a point, unless it has been cut hollow in the centre with the saw; but, if done in this way, it will be necessary to round as much of the edges as to make it have a declivity from the centre, so as not to lodge water on the top.

If the sawyers would incline the teeth of the saw upwards, it would prevent this occurring, and would render the stool easier dressed. An objection has been made to this mode of cutting with the saw, as taking up too much time; but I have found that two men, with a cross-cut saw, the saw being kept in good order, will cut as much down as two men will with an axe,—and wood will

also be saved, and the work done to much better purpose than when cut from the plant with an axe.

I have often found, in cutting trees from the plant, where the root did not exceed ten inches in diameter, that by cutting them with the saw without being hosed, or any of the bark being taken off before the saw, but to enter the saw about an inch above the surface of the earth, and inclining the saw to run up an inch towards the centre of the root of the tree, cutting it from both sides, that this makes an excellent cut, and all that is afterwards necessary, is taking a sloping slice all round the outside of the root, say inclining towards the centre about two inches broad, and taking it down to the ground. In attending to this you have a very well dressed up stool, nearly formed by the saw itself, which is both speedily and easily done ; and in this case there is no danger of loosening the roots by the blows of the axe.

Having thus described the cutting of a natural wood for growth from the first plant, I shall now proceed to consider the method of cutting old natural woods, such as have been cut once or twice, or a number of times, which often require a different treatment.

SECTION VIII.

OF CUTTING NATURAL COPPICE WOODS FROM THE OLD STOCK.

It was formerly the custom, and even at this time some insist on its propriety, to cut trees, intended to grow again, four, five, and even six inches above the surface ; but a worse practice, or one that more points out its own fallacy in natural woods, cannot be conceived. When this is done, you will see hundreds of

the stools two, three, sometimes four, feet above the surface of the ground ; and many of them have attained such a size, that the main body of the root is altogether out of the earth, and this root is nourished by perhaps no more than three or four fibres or small roots, and these must, of course, afford a very scanty supply to four, six, or even eight trees, which should be produced and supported by such a stool. Hence, we generally find, that trees produced from such a stool, are neither so healthy, nor do they produce the same quantities of bark or wood as stools do which have been dressed as they spring up from the ground. Besides, the shoots, for the first year's growth, are so very tender, that if there is a fall of snow during the winter, they must sustain all the weight of the snow that the whole stool carries, or nearly so, and ten chances to one but they are broken off, and the year's growth completely lost ; whereas, when the stools are cut, so as to be dressed down to the ground, the snow can have very

little effect on them—the stool bears no more weight than its proportion with the ground. But besides their liability of being broken off with the fall of snow, shoots coming out from a stool from one to four feet above the surface of the ground, never make much progress, nor are they nearly so productive, either as to wood or bark, as those from a stool cut down to the ground: besides, they make a very ugly appearance in a wood. A stool having stood in this way for three or four cuttings, will be found mostly red wood to the outside; and it being only from the bark and sap, or white wood, that the young shoots receive their nourishment, and only in so far as there is sap or white wood in the old stock, does the young sapling cement and become one with the old stock or stool, and we always find that stools of oak in particular, that have most sap-wood, make by far the best and most vigorous growths: the same will hold in pruning off an oak branch that there is red wood in the wound, which never will

cover, and will always leave a blemish in the tree.

It will be found, upon experiment, perfectly evident, that stools dressed down to the surface of the ground, (taking care always not to loosen the bark from the root, or allow it to be peeled off in the smallest degree below the earth, but rounded down level to it,) will send forth the most vigorous shoots, and stand the weather, and be the stoutest and best throughout the age of the coppice, and are always the best for layering to fill up blanks.

But to redeem these old stools, I have tried the experiment of cutting off with a saw the old root close by the earth, or I have even cut it away altogether, when, as is frequently the case, one can see between the main root and the ground, and dress up the ends of the fibres or small roots that were supplying the old one with nourishment, and exposing these open to the sun and air. In this case I have often seen, and have had most excellent

shoots; and the chances are infinitely greater, and more good will be done in following this plan, than from allowing shoots to spring from the old stock; and from every one of the fibres that was supplying the old stock with nourishment, you will have two or three young shoots. *

One reason why old stools are apt to get above the surface of the earth is, that, after the first cutting, the stool having sent out two, three, or perhaps four different shoots, which are all to be nursed up to the age of the coppice, and, when they are to be cut, which is the easiest and speediest way for the purchaser, each of these is lopped off with the axe; and this makes a very good stool, and requires little if any dressing up, because the

* Many proprietors of natural oak woods, since the first edition of the Forester's Guide was published, have tried this method with overgrown oak stools, and have found the cutting down to the ground to answer the purpose far beyond their expectation; and in place of poor scraggy sickly shoots, have, in one season, had the ground covered with a profusion of fine healthy vigorous trees.

stool, when cut from the plant as directed, and having been rounded at the top, still retains this form, and the shoots coming up around the edges of the stool, by cutting them separately, inclining the edge of the axe from the earth upwards to the centre of the stool, taking care to leave the bark and wood, as if forming one piece, on that part of the stool close to the earth, when the axe is first applied; but let it be carefully noticed, that these must always be rounded down close to the earth.

In cutting in this manner from the old stock, with those there is no more danger than in cutting with the saw, as the root is not now so liable to be loosened as when cut from the plant. This latter method, though it answers exceedingly well for the first or second cutting, after having been cut from the plant, yet it has a very great tendency, in course of a few cuttings, to raise the main root or stool to a considerable height; and, as soon as the main root raises itself about

ten or twelve inches, it should be cut through with a saw, and dressed up in the manner described in cutting from the plant.

I have often seen an oak stool on the face of a rock, having one of its sides level with it, while the other side was perhaps two or three feet above it ; and from this latter side the nourishment is more generally received, and therefore the shoots sent out from a stool of this description are in general small,—not arriving, at the time of cutting, at half the size that from a well dressed stool should be expected.

In such case I have tried the following experiment, and have found it to answer extremely well. I made use of the saw, and in the following manner : I enter it at the higher part where it is level with the earth, inclining it during all its progress downwards, until it comes out close by the earth at the lower side. In consequence of this manner of treatment, I have found the shoots come out from that part of the stool where it pos-

sessed most moisture, and receiving their nourishment, as it were immediately from the earth itself, and not altogether depending on the old stock ; and these shoots will be found to make as much progress in one year as they formerly did in three. And whereas formerly the old stool only gave out two or three puny sprouts, which, from the weight of snow in winter, and other causes, can never obtain a perpendicular or upright position, but on the contrary come out sloping, and in a horizontal way, always growing crooked ; but by cutting in this manner, you will have double the number of shoots from the same stool, and these shoots will also be taller, straighter, and stronger, and the stool from the cutting will consequently be proportionally more valuable.

There is scarcely a coppice or natural oak wood in the Highlands of Scotland, but abounds in stools of this description ; but by pursuing the plan above recommended, their improvement will be rapid and great, their

appearance will be greatly improved, and their value greatly increased. Here it may not be amiss to give the forester a hint, that in cutting an old coppice or natural oak wood, chiefly with a view to its improvement, he be sure to fill up carefully by layering all the blanks, and, if possible, bring it to have a crop of standing stools upon the ground, at eight feet stool from stool; and, if this be properly attended to, there will be an excellent crop by next cutting. Having thus recommended what I conceive to be the best method of cutting and improving old natural woods, I shall next consider the *time* proper for cutting; but as this is a subject which is pretty well understood, a few hints will suffice.

SECTION IX.

TIME FOR CUTTING OAK WOODS.

EVERY one must know, that if a tree is to be barked, the time most proper for cutting is when the sap is in the tree, and more especially when it is ascending, or as soon as the bud begins to make its appearance, which, if the spring be favourable, will be in the end of April, or beginning of May. Birch and larch woods are also peeled, as their barks are used in tanning, but these will peel nearly a month earlier than the oak. Should there be no frost, birch and larch may be peeled about the beginning of April; but the birch is commonly allowed to stand till July, and the peeling of it is commenced after that of the oak has been completed; and for this reason, that there is an outer skin upon birch

bark, which requires to be taken off, as it is of no use to the tanner, and renders that part which is of use more difficult to grind with their bark mills; and the month of July, or even August, is the only time at which the two barks can be separated with ease, as at this time the juice or sap has made its circulation through the tree and bark, and this circumstance renders the separation more easy.

From the beginning of May to the middle of July is the usual time for barking the oak. The earlier in the spring this operation is performed on the oak, both for the growth, if a natural wood, and for the bark, the better. When the sap has begun to rise, the bark will easily be detached from the wood, and it ought then to be taken off without loss of time; and if the whole could be taken off before the leaf is completely developed, the bark would be better. After the sap has arisen to the leaf and new growth, the bark becomes more dry, and requires more beat-

ing to separate it from the wood. And when what is called the black sap is descending the tree, the bark taken off is black, and loses its original colour ; and at this time also the bark begins to throw off a scurf, more especially young bark without much cork on it ; this outer skin having less of the proper sap or juice, and being much drier when taken off, will weigh less, and consequently will not be so valuable.

If possible, oaks should be barked by the middle or end of June ; but this, when there is a great extent to be cut, may be impossible, though it is equally disadvantageous to the proprietor and purchaser to cut and peel after that time, as every ton of bark taken off after the 1st of July will be deficient two cwt. per ton, compared with the same quantity taken off in May, or early in June.

The time of cutting is generally fixed for the 15th day of July, and after this date there should not be a single stool of oak wood cut that is intended for the growth ;

and as soon as possible after the 15th, the whole of the wood and bark should be carried away, that the young growths may not be disturbed or injured, as at this time they will have made considerable progress ; at any rate there should neither be wood nor bark remaining within the new cut hag after the 1st of August ; nor should either horse or cart be permitted to enter it after that period.

I know the time allowed for cleaning and clearing out woods, and removing wood and bark, is generally extended to Martinmas, and sometimes even to Candlemas ; and, where there is much to be done, it can scarcely be completed before Martinmas, or middle of November.

It would be advisable for the proprietor to assign some spot of ground in a corner of the wood, or, what would be preferable, some place distinct from it, to the purchaser, in which he shall stack up the bark, if it be determined that it should remain for any length

of time after cutting. To this place also he ought to remove the wood ; for, as I have already said, these remaining on the ground will be apt to disturb and injure the young growths. It is well known that trees, and oaks in particular, after the beginning of August, make what is termed a Lammas growth, and the future prosperity and health of the coppice in a great measure depend on the first year's growth, as far as regards form and vigour of the shoots, as will be shown in Section X.

Let it be carefully kept in mind, that as soon as the wood and bark are removed from a natural wood, the fences should be thoroughly repaired, to prevent sheep and cattle from entering ; and, even from the time of cutting, particularly after the growth has made its appearance, horses should not be allowed to go at large in it, while brought thither for the purpose of removing the wood and bark. It is a well-known fact, that cattle, sheep, and goats, do more damage to

young plantations, and more especially to young natural oak woods, than can well be imagined or described. One would think that those who do not keep cattle of every description out of young natural oak woods, do not wish to see them thrive. After the 1st of August, when the cutting shall have been finished, and it is proper, as before stated, it should be so, the gate should be locked, and the wood as completely secured as a man would his desk, into which he had put his money, to preserve it from thieves.

It is difficult to say at what time cattle should be permitted to enter these woods to pasture. Some have stated five years as the proper time, others eight; I, however, differ from both. I have no hesitation in saying, they ought not to be put in till the natural wood shall have attained at least ten years, for the above reason, among many that might be stated.—I suppose, as I recommended, that all blanks which occur in the coppice, are filled up either with young oaks, or by layering; or if none have been planted, still

there are seedlings springing up, which may come to be fine trees, and which ought to be preserved.

In natural wood of old standing, there is generally a quantity of what is termed, in Scotland, black or barren wood, (such as ash, plane, birch, elder, &c.) and these are often not cut until after the oak is all cut and barked; and cutting and removing it from among the young growth of oak wood does more damage to the new cut hags than they are worth: it is, in truth, a practice destructive and awkward. Here the purchaser makes use of an excuse, and throws justly all the blame upon the proprietor himself. "Why, yes," says the purchaser, "I know it is the source of much injury to be cutting and removing the barren wood, after the oak growths have made such progress; I bought it and must have it out; this wood was not exposed to sale till late in March, (or April, as the case may be;) I did not become the purchaser sooner, and it is impossible I could have it all cut down before the oak was ready

for peeling ; and during the time of cutting and barking the oak, from which I am to derive the principal part of my profit, I could not attend to it." He will argue, if there be any part of it more particularly valuable, " It was not then the season for cutting wood of this kind ; that it ought to be cut early in the spring or autumn, and the thing must be done whatever destruction it may cause. I am perfectly aware I am bound by the articles or conditions of sale not to injure the young shoots; but here is a large stool of five or six ashes, elders, or birch, &c. surrounded on every side by fine stools of oak, and these have five or six shoots, some of them two or three feet long, but I must have away these birches, ashes, &c. and I must have a fall to them. I cannot take them on my back as they stand, and carry them out of the wood."

The purchaser sets the cutter to work : he fells one ; it falls right into the midst of an oak stool, and breaks off all or the greater

part of the shoots ; another falls in an opposite direction, does the same, and so on till the barren wood trees shall have destroyed as many, if not more, fine oak stools than all their value, and which most probably make all that cutting a mere blank.

To remedy this evil, the proprietors of natural woods, who intend to sell, should put these woods that have a great proportion of black wood in them to sale, if possible, in autumn, or if that cannot be done, they should not be sold later than January or February, and binding the purchaser to cut down all the black or barren wood, before beginning to the oak ; and to have it carried off along with the oak and bark, giving him a reasonable time to fulfil his engagement : if the whole is oak, they may be sold any time before the 1st of April.

This mode of selling natural oak woods, where the quantity of barren wood is great, can be attended with no inconvenience to the proprietor ; for the price of bark is never

positively known for the ensuing season, nor indeed till some time in May ; and in valuing these woods, either for sale or purchase, the calculation is made from the prices of the same kinds of wood and bark so sold the last season, unless there is some evident apparancy of a rise or fall in the prices of wood and bark, from which certain circumstances are expected to take place. An early sale is also in favour of the purchaser, and he will be inclined to give a better price, as he has sufficient time to look out for the most proper workmen, and has every thing in perfect readiness to commence the barking as soon as the bark will rise, and of course finish his barking in proper season. On the other hand, if he does not make the purchase until April, if he has 100 or 150 tons of bark to peel, he requires to procure 100 hands, or more, and perhaps has to provide tools ; and if the quantity be more than he is accustomed to have in his possession, before he is aware the season is advanced, he loses per-

haps the first fortnight, and not unlikely the month of May has passed before he has proceeded any great length; he sees he must now hurry on, and gets confused; at any rate he is obliged to peel for a fortnight or more longer than he ought at the end of the season. In this case both he and the proprietors are losers. I would therefore recommend the sales of natural coppice woods, on no account whatever, to be at a later period than the month of February, particularly if there is barren or black wood to be cut.

SECTION X.

THINNING AND PRUNING NATURAL COPPICE WOODS.

THIS is a part of the forester's work that ought to command and occupy his most particular attention. The time to begin to thin

these woods, say some, ought to be the third year after cutting; others say, five or six: and this is the most general time throughout the Highlands of Scotland, but particularly in Argyleshire, which abounds with natural woods, and beautifies, in a most superb degree, many sides of the barren mountains in that country, particularly about Inverary, and both sides of Lochfine, as also all the lochs. Some are not for thinning till they arrive at eight, ten, and twelve years of age; but nothing can be more destructive and absurd than this. These newly cut stools, the very first year, that is to say, immediately after cutting, or as they may be called, the Lammas growth,* throw out from many of them ten and twelve different shoots, and some

* All oak trees, when young, but particularly when springing from the natural stool, advance with great vigour, and make every year two shoots, one in the month of June, and the other commencing in August, called the Lammas growth, which usually continues to grow till the frost stops it in the end of Autumn; and this is always the most valuable growth for natural oak coppice, and ought to be particularly taken care of.

of them come up like a handful of grain thrown into good ground, or like a bush, covering the whole stool. This, say the advocates for ten and twelve years growth before thinning, is nature's own work, and all should grow together for these years, and then the thinnings will pay the expense of thinning. Those, again, for thinning at three and six years growth, say that, as the tree when cut was in the most thriving and healthful state, the root retaining its sap, and having little to supply now besides what it formerly had, it, of course, is able to supply abundantly all the new young shoots that come out from it, and they ought to stand for at least three or more years, and then it will be well seen which are the properest shoots to live. I grant that it is nature's own work to throw out all those shoots from a newly cut oak root, and I grant also that nature is ever kind to her own children; but nature may be overburdened, and she is effectually so in this case; and I say it is impossible for

a tree root, which is perhaps only ten inches in circumference, or say even twenty inches in circumference, and few are this size, to cherish or nurse up, with any degree of health or vigour, ten, or even twenty young shoots or trees, either to three, six, or ten years, without the tares spoiling the wheat, or the lean cattle eating up the fat, as the one must be evidently spoiling the other; so that the whole crop is much spoiled and lessened in value when it comes to the axe, by want of early thinning. Therefore every natural wood, the second year, should undergo a thinning, that is to say, it gets all the Lammas growth, as it is called, the year it is cut, and then allow it all the next year's growth, when, any time after, from the month of October to the first of April, let the whole wood be gone through, and clear or take away all the growths or young shoots, excepting those you are sure of coming forward to maturity, leaving, at this time, one or perhaps two shoots more on every stool, than what it may

be supposed able to nurse up to the full time of cutting. Great care ought to be taken at this time to divide the shoots that are to remain equally, that is to say, to have them at as equal distances from one another, round about the stool, as possible ; at the same time, not leaving on any stool, unless a very large one, and that too in an open part of the wood, more than six or eight shoots. This will be found to be as much as any stool can nurse up to the usual age for any purpose. By this early thinning, you have it in your power to leave just such a crop upon the ground, or rather upon your stools, as you are sure nature is able to cherish and nurse up, without overburdening it. At this early period of the thinning, too, you can do it easily, without in the least injuring the shoots that are to remain, as it can be readily done with a short knife ; but the newly invented instrument for thinning natural stools will be found much more handy, and will do it more speedily, safer, and to better purpose,

which we may term the Coppice Thinning Chisel, (see the plate,) cutting them off close to where they came out from the stool ; and at this time, too, you have an excellent choice of shoots. By your being three or more years in giving the first thinning, you must have recourse to a pruning hand-bill ; by which means, if in the hands of an inexperienced person, the proper shoots are often hurt ; and, besides, when taken off at this age, the bark is often loosened from off the root, so that worms and other injurious animals get in betwixt the wood and bark, which sometimes proves fatal to the whole stool. I would therefore recommend early thinning, as I have found it, in the course of my experience, to be the very life of a natural wood.

All natural woods make either less or more progress the same year they are cut, that is to say, if the cutting is finished on or before the 15th of July. The stools cut in the months of May and June make most vi-

gorous progress. To give one example here, amongst many that might be given—I was engaged at an oak wood-cutting, in 1818, on the estate of Fotheringham, in Forfarshire. This was cutting from the plant, in order to turn it into a natural coppice wood. We only began cutting the oak on the 18th day of May, and towards the end of July I measured three several growths, from three to four feet long, and by the middle of September, from six to seven feet long. See also the growth mentioned in the Introduction, on the Airthry Estate. I grant those were very extraordinary growths, but I have often witnessed nearly the same in many other places. And who would not say but that these should be encouraged, and allowed every chance of coming forward, by taking away at once all superfluous growths from the stools, that they may get all the sap and nourishment possible, as it is well known that every green blade must be supplied with a part of sap or juice from the main root?

Having thinned them the second year after cutting, little more will be necessary for some time, unless to go through and prune a little ; at the same time keeping down all young suckers from off the stool. Here it may be very necessary to observe, that the value of coppice woods chiefly depends on the quantity of bark produced from them, and the more branches consequently the more bark ; and some argue there should be no pruning at all. Let it be here observed, however, that the wood of coppice, properly trained up, at the age of twenty-four years, may be of considerable value ; and its value chiefly depends on its tallness and straightness ; because, if the timber of a coppice wood, although thick enough for many purposes, if very crooked, is almost of no value but for fire-wood. I consider it, therefore, very advantageous for a coppice wood to go regularly through it the second or third year after being thinned as described, and prune with caution all those shoots you think will

remain to the full time of cutting, pruning them up from the root, and taking the most of the twigs off that side of the main stem that inclines to crook, in order that it may be drawn up in as straight a position as possible. This will be found to be of very great advantage to the cleanness, and also in aiding the straightness of the timber of a natural coppice wood. Those stems you left when thinning, supposed to be taken out at half time or sooner, ought not to be pruned, but allowed to grow any way, and as rough as possible, taking care, however, that they are not interfering, or in any way hurting the main stem that you intend to carry up to full time. If you find any of them that were thus left taking too much of the juice or nourishment from the main stem, so that the whole is getting sickly, then they ought instantly to be taken away; and see that there is no more left than what the main root is able to nourish up. I said two more may be left at this time than what the sub-

stance of the root will bring forward to full time; but this will depend a good deal upon the soil, &c. &c. and the healthiness of the shoots.

Having thus thinned during the second, and pruned during the fourth or fifth year, little more will be necessary now till the tenth or perhaps the twelfth year, when the whole should be gone over, by taking away those stems that were left as a kind of nurses to the main ones. Here it is difficult to say how many should be taken. Some stools may do with all the six, others with five, others with four, and some only with three. In the first place, care must be taken to leave no more than what you are sure the stool will nurse up to the full age intended for the coppice, as the stronger the shoots become they always require the more nourishment. It will now easily be seen if any of those shoots are receiving sufficient supply of nourishment; if they are not they will become stunted in their growth. Those, therefore,

ought to be taken away, and likewise those that are wholly overtopped, and are not likely to get forward to any kind of maturity during the age of the coppice. In the second place, it will be necessary here, carefully to look round about the bottom of the stool, and if the stools are thick upon the ground, take the most from those sides that seem to press most upon one another. At the same time, it may here be observed, that a natural wood is not like single trees training up to maturity; they will thrive well although pressing a little upon one another, if it be not so as to hurt each other; that is, the one altogether overtopping or bearing down the other to its hurt; but they are the better for being a little pressed sidewise, as it has a tendency to cause them to grow more upright, and of course more straight. The thinning we are now attending to ought to be done in the barking season, and the bark peeled off what is cut, and preserved. This will be found to do something more than pay

the expense of thinning. Being done, however, at this season, the bark of the remaining shoots will be very easily hurt, as also the bark of the stool; therefore the greatest care is necessary that neither of them be injured. I have always in this case found it a very great saving, in place of an axe, to use a very narrow-ended hand-saw, one that will go in betwixt the shoots, and cut the one to be taken away easily out, without in the smallest degree injuring either the bark of the stool or the remaining shoots. If the saw is kept in proper order, it will be found more speedy than the axe; but in place of the saw, use the newly invented thinning chisel.

I have often found it of great use to go through a neglected coppice wood, one that had never been properly kept, even at the age of twelve or fifteen years, and dress it up in the manner described; and have been very sensible of their making more progress in one year, after having been thus dressed up, than before they did in three. So that I would

recommend to all those having the charge, or coming into the charge, of natural woods, although they have been neglected until they are at the age of even fifteen years, to go through them in the way directed; and I doubt not but what they take out will pay more than the expense attending it; and I am convinced, that at the end of twenty-four years, say nine years after, they will have a third, or nearly so, of more bark on every acre, and the timber will be considerably improved, and of much more value. It has been objected to by those advocates * for ten years before any thinning takes place, that to do it any sooner would cost a great deal of ex-

* The natural woods in the Torwood, in Stirlingshire, are of very ancient date. The *Upper Wood*, as it is called, the property of Colonel Dundas of Carron-hall, was (until about fifteen years ago, when Mr. Alexander Mills got the charge of it,) like a wilderness, and many acres of fine natural woodland would not produce one ton of bark; but, by Mr. Mills's exertions in carrying on a system similar to what is here laid down, these very acres, by cutting-time, will, on an average, yield from five to eight tons of bark. The manner that these woods, under his charge, are thinned and kept, does him much honour, and is worthy of the forester's imitation.

pense, and nothing for it, whereas now it will pay the thinnings :—the advantages of early thinning has already been pointed out, which answers this objection. The expense of the early thinning is very trifling. I have had a man under my charge that has thinned regularly every day upwards of 150 stools, or about one thousand in a week. Now, say the stools are about, or nearly, eight feet distant from one another, which they ought to be, a man does an acre in a week, for which, perhaps, he receives fifteen shillings; but by the new thinning chisel, a man will do four times the above number : now, the next thinning, at half age, or thereabouts, of the coppice, is so very superior to what they would have been, had every thing been permitted to grow, that this thinning pays itself and the former thinning with interest, and the wood is 25 per cent. better at the end. By the system of late thinning, I have known many stools irrecoverably lost.

SECTION XI.

OF CONVERTING A COPPICE INTO A STANDING OAK
WOOD, AND OF LEAVING RESERVE TREES IN IT.

It has been, and still is, an objection with many, that when a wood is once cut over, and become a natural coppice wood, that it must for ever remain so, as nothing more can be done with it but to cut it over every twenty-five years, or thereabouts; and should a time arrive when there is no great demand for oak-bark, this wood must at all events be cut down, and brought into the market under such disadvantageous circumstances, both as to the prices of bark and of wood, as may occur. But this is false reasoning, as there is scarcely any soil that carries natural oak wood to the age of from twenty to thirty

years, but will also carry trees forward to full maturity, if rightly dealt with for that purpose. If it be, therefore, thought proper, either from the local situation of the wood, where it would be more profitable to have full-grown timber, or even for ornament, to rear them up from the stools to maturity ;—supposing the stools have been dealt with as directed in the foregoing section, to the age of twenty-four years, or thereabouts, and it being thought now more advisable to bring as many of them as possible to be large trees, it will then be necessary to cut over about a third part of the whole stools, and at the same time to dress up the stools as directed for the growths, as these must now be reared as underwood ; then to thin out from the stools untouched, which will now be about 24 feet distant from each other, taking the worst of the shoots, leaving on an average at least three shoots on every stool ; and these must be the best and healthiest of

the shoots or stems; at the same time pruning them up with particular attention, taking most of the sprouts from off the inside of the stems of the remaining shoots, pruning them up from the middle of the stool, taking the inside shoots towards the top. Having now plenty of room to spread out on all sides, they will do so with amazing rapidity. As the under coppice cannot be expected to make such progress as when the whole is cut down, it will be also necessary, the second year after cutting, to thin those stools, so as to leave from six to eight shoots on an average on each of them, allowing them to grow in their rough state, without any pruning, as they must now be cut away every fifteen or twenty years, chiefly for the bark, and kept as underwood. At the first cutting off of the under coppice wood from amongst the large stools, as they will now have made very considerable progress in size, they will require a little more room, and may be at the time,

say fifteen years after being left, when the under coppice is cut, thinned out, to about 30 feet distant from each other. This is by far the most profitable way of rearing oak woods: if any of these left misgives, new shoots must be trained up as trees to supply their place from the underwood stools.

In order to have large trees in any plantation, they must be thinned out at least 30 or 34 feet distant from each other; and here, on an average, you have only about sixty trees on an acre; whereas, from the natural shoots you have three times that number, and their growth is much more rapid than from the plant. In this case each acre of natural oak trees, nursed up to 70 years of age, will contain about 180 trees, which will average at least 30 feet each tree, making 5400 feet, say at 4s. per foot, including bark, (which is but a low price for such trees,) makes L.1080 Sterling, per acre, or upwards of L.15 per acre per annum, besides all the under coppice wood, which will all along have done

a great deal more than pay a fair rent for the land. Some will be ready to object, and say that trees will not grow to these sizes, three out of one stool, within the compass of 30 feet. I could here give many instances of this that have come under my own observation; but the following may suffice, which must have commanded the attention of every traveller; and every one who is delighted to see the bulwarks of our nation in a flourishing state, must have stood still to admire it. This oak stool I refer to, is on the estate of Touch, in Stirlingshire, and grows close upon the public road side leading from Stirling to Dumbarton, between four and five miles from the former place, where there are to be seen three trees growing from one stool, the least of which contains about 40 solid feet; the three added together making on an average upwards of 150 feet, and not occupying more than nine feet of ground any way; and this natural stool of oak is not more than from 70 to 80 years of age. On the opposite

side of the road, at the same place, is a single oak tree from the plant which I am informed was one of the reserve trees in that coppice. When this stool was cut, it must have been of very considerable size at the time, as the tree does not measure more than half the contents of the natural ones put together, and occupies a great deal more ground than they do. There are a great many more natural oak stools on the same estate, near the house, not much beyond half the age of the above tree, that have three, four, and five stems from them, and will average 30 feet each stem.

Allow me to give one more instance.—There is a natural stool of oak on the farm of Bareside, estate of Touchadam, the property of William Murray, Esq. This stool has seven stems growing from it. One of these stems, which has been over-topped by the others, on account of their never having been properly pruned up, has become dead, though there are still about three solid feet in it ; the

other six stems are really each of them large and magnificent trees, and on account of their having been left entirely to Nature's own care in rearing, their main stems are extremely short to what they might have been, had they been timeously pruned up, but they are remarkably well adapted for ship-building, and each of the six stems would make timbers and knees for a vessel of from 160 to 180 tons. The six stems put together measure no less than 180 solid feet ; and as there are more branches on this stool, in proportion to its measure, than on the one before alluded to on the estate of Touch, of course it will produce more bark in proportion to the number of feet. It may be observed, that from the great value of the crooks of this stool, it is well worth 5s. per foot, including bark, which, for 180 feet, is L.45 Sterling. From the way that the stems of this stool have been obliged to spread, it covers a great deal more ground than the one referred to ; yet an acre of ground would be

very capable of carrying 40 such stools as this, which would be no less than L.1800 Sterling per acre ; and, I am informed, this stool is not more than seventy-five years of age : this is no less than L.24 per annum per acre ; and I have no hesitation in saying, if my information is correct, that, from the poorness of the soil of this farm, two acres of the under coppice woods would have paid the proprietor annually, all the rent he has received for this whole farm for seventy years past. This magnificent stool of oak grows not more than a gun-shot south of the public road leading betwixt the villages of St. Ninians and Cambusbaron, and not more than one mile and a half from the town of Stirling, and at that distance it only appears in the eyes of the traveller to be a mere bush, though its large spreading top appears most beautiful ; but how pleasingly deceived he is when he approaches within the cover of its spreading branches, and beholds not a bush, but stems fit for the principal timbers of a large ship, and that too one of Nature's

own children, nursed by herself, as it is plain no attention had been paid to the rearing of it, and that too from the poorest part of the soil. It is customary to leave standers or reserve trees amongst coppice, but when it is intended all to be cut over, it is rather hurtful than otherwise to the undergrowths. It may, however, sometimes be necessary, for the sake of ornament, &c. to leave a few of them, and these ought to be the straightest trees, and, at the cutting of the coppice, they ought to be particularly pruned up, especially if those left are seedlings, or from the plant; and the tops of them ought to be a good deal lightened, so that the wind may not blow them down, nor shake them too much, so as to loose them at the root, as it causes them to lose the growth, which is often the case if they are left in very exposed situations. It is very proper, in all coppice woods, to refrain from cutting all young seedlings at and under four inches circumference three feet from the ground, as those

will come forward to be good trees by next cutting, and may perhaps supply the place of old stools that have been hurt in cutting, or that may be on the decline from some other circumstance.

After giving these two examples amongst many more that might have been given, the reader will readily see, that it is not only a very easy process to turn a natural coppice wood into large trees, but that it is the speediest way of rearing oak trees, either for valuable purposes or for ornament.

SECTION XII.

TRIAL OF A NEW METHOD OF THINNING NATURAL WOOD.

THIS new method is founded on an experiment I made in 1810. At this time I tried

only six stools of oak, which I particularly marked in the wood. I visited them every year regularly for four years after, and found them doing extremely well. I saw them again in 1819, nine years after the experiment, and found them doing equally well with the best stools in the coppice, and far superior to a great part of it. I have, every year since 1810, tried the same experiment with less or more in number, and have all along found it to succeed extremely well, and in many instances far outstripping any stools in the rest of the coppice, and they had no occasion for the least thinning, nor the least attention being paid them ; but I have not yet lived to see a second cutting of any of them, nor am I as yet perfectly assured whether or not it may not be detrimental to the root or stool after next cutting, although from their healthy-like appearance, now nine years after, I hope not. I shall submit the experiment to the reader, and those managers of woods who have it in their power to

make trial of it, and should it succeed, it would save a great deal of expense and trouble in training up coppice woods.

The plan is this: Immediately after the tree was cut, and the stool dressed up, I went through and selected a few stools, for the purpose of trial. The first stools I pitched upon in 1810 were cut from the plant, and the diameter of the least was eight inches, and the largest not above twelve, making 24 and 36 inches in circumference. These stools I divided some into eight and others into twelve parts, and with a peeling-iron I took off from some four, and from others six parts of the bark, pulling it down below the earth, and taking it completely off the root, taking care not to loosen the other four and six parts of the bark from the root, but leaving it perfectly entire at equal distances round the root; and from every one of these stools, which I have tried in the way described, less or more every year for these nine years past, not one stool out of ten but what has

sent up fine healthy shoots from that part of the stool where the bark was left ; and many of these stools I can at this day point out in the most thriving condition ; nor have they ever required thinning, as they just throw out such a number of shoots as there are pieces of bark left on the stool : and I can add here, that I have tried the main bodies of the stools, and have found them to be as full of sap as those stools having all the bark left on them. Should this method succeed in after-cuttings, of which I have now little doubt, what a vast improvement it would be, and what a saving ! One man going after the cutter, could prepare at least a hundred stools every day, and the wood would require nothing more till once it came to the axe again.

I hope these few hints, which are dictated by experience, will induce an early trial to be made by those who have it in their power ; nothing can be lost by it ; as at first the trial may be made in stools, which it does

not signify much whether they are lost or not. Those taken should be such as are in places where they can be spared ; but at the same time doing it justice by using a thriving stool. The stools thus thinned in 1810 are still now, 1824, in as thriving and prosperous a state as any of the stools in the coppice, and there is not the least appearance of the stools having suffered the least injury from the parts being peeled.

SECTION XIII.

OF EXTIRPATING BARREN WOOD FROM OAK COPPICES.

THE natural woods of old standing used very much to abound with what is called barren wood, such as birch, elder, saugh, hazel, and the like ; and indeed great quantities of these

are still to be found on good land, perfectly capable of carrying fine oak.

About ten or twelve years ago, when oak bark was selling at from L.18 to L.20 a ton, the proprietors of oak woods began to see the advantage and propriety of having, if possible, all their natural woods of oak, and where what is called the barren wood was growing, it was extirpated, or kept down, and oaks planted in its place. The only way of keeping down these kinds of woods formerly was, every spring before the growth was far advanced, men went through the woods with axes, and cut off all the shoots that had made their appearance during the preceding summer ; and this had to be repeated annually during half the age of the coppice, which was a laborious work ; and, even after all this, many of the young plants were choked with this kind of stuff ; and besides, it never was fairly rooted out or extirpated. About eight years ago I fell upon the following plan, which, in my experience,

and the experience of every man who has followed it, has been found to answer the purpose most effectually. The plan is this : if you have any of those trees which you want to extirpate, let them be cut in summer, when the sap is in them. You may do so along with the oak, or at the time of peeling. After being cut down either with an axe or otherwise, a person must be sent through with a peeling-iron, and made to peel all the bark off round and round the root, considerably below the surface of the earth—to the bottom of the root or stool if you can, and the iron will easily do this ; at any rate, be sure it be taken off all round the root, and completely under the surface of the earth ; and this, if properly done, will be found effectual, and that too once for all, for it will require no more work to keep it down, as all further growth or vegetation in the shoots is by this plan effectually checked.

I could mention many woods where large quantities of birch and elder, and other woods,

have been extirpated from amongst oaks in this way ; and the expense of doing so at the time is very trifling, and then it requires no more work to keep them down afterwards, as they are in this manner, as already stated, effectually destroyed. And when the wood is to be planted up with oaks, whether by oak plants, or by layers, these may be put in or brought close to the birch, elder, or any kind of black wood stools, and receive no injury from them, so that the whole ground in the very season after cutting may be filled up, and converted wholly into an oak wood.

SECTION XIV.

OF VALUING STANDING OR GROWING TREES AND WOODS.

HAVING now finished, in as brief a manner as possible, what I intended to say on

planting and thinning, pruning, cutting, and training up young plantations and coppice woods, which I hope will, in the mean time, be found sufficient for that part of **THE FORESTER'S GUIDE**, it will be now necessary that I lay before the forester, to complete his guidance, the manner and method of valuing coppice woods at all ages, as also of measuring and valuing standing or growing trees, of all kinds and sizes; and this being a subject on which none that I have either seen or heard of have either written or said any thing, I must be excused if I should exceed a little the limits at first prescribed to this work, as I must be here somewhat particular. It will be necessary, in the beginning, to give a brief description of the kinds of timber used for most particular purposes, and of course bringing the highest prices; and in this, as in the other part of this work, I shall use only such names for the different kinds of wood as are understood and used throughout Scotland, so that every

person, in the least connected with the selling of woods, or working amongst them, may easily understand me.

A plan will be found at the end of this part of the work of my newly invented instrument for measuring standing trees, with an explanation of the manner of using it, whereby any tree, with its branches, can be measured as accurately and expeditiously as if it were lying on the ground, whereby a difficulty of a very serious nature, and of which I myself have often been an eye-witness, is completely removed ; that is, I have often seen a ship-builder apply to a gentleman for a particular tree or trees, say for a keel piece ; the gentleman sends him to his forester, and desires him to give him any tree or trees out of this or the other part of his plantations, as will suit his purpose, for which he is to pay a very high price ; well, the carpenter knowing he is to pay a very high price, wishes to have the tree or trees he requires as near the sizes

as to length and girth as possible, not to have much waste of wood, as he knows he is liable to pay for the whole measurable timber which it contains. In search of this tree or trees they go through the plantation, backwards and forwards, till perhaps it is near the evening; they now fix upon one or two trees as is required; and two or more men with saws and axes, who, either at the proprietor's or carpenter's expense, have followed them all this time, set to work and cut one down, it is girthed and measured in length; well it is too small at the top; a second is cut down, it is the same. Says the carpenter, "They may well do, if a little too large, but they cannot do too small or too short." He, as I said before, again to save money, and to get them as near the sizes as possible, still cuts, till he has perhaps cut five, six, or eight trees, before he gets one or two to suit his size; therefore, although the proprietor gets 4s. or 5s. per foot for one or two of those particular trees, where is his profit? The carpenter or merchant puts him off with a plausible

story, saying, “ I will likely require these others next year for a smaller vessel, or soon, and I will give the same price,” whereas, they are allowed to lie on the proprietor’s hands till a merchant casts up for them; but before this occurs, the trees begin to spoil, and he must now sell them for purposes not so valuable, rather than lose them, perhaps receiving only half-price for them. I have seen cases of this kind more than fifty times; and I have myself often been authorized by gentlemen to give a particular tree or trees, for especial purposes, both in machinery and ship-building, and have been deceived in the manner just described. Now this instrument for measuring standing trees removes all these difficulties, as with it you can take the exact length and girth of any tree, either at the extremity or any part of the body of the tree, with the same exactness as if lying cut on the ground; besides, if the proprietors of woods chose it, they could have all the large or full grown trees in their plantations, or in any

part of them, numbered, and their measurements accurately taken and set down in a book ruled for that purpose ; so that a gentleman at London, abroad, or any where at a distance from his estate, carrying with him a book in which are the dimensions and measurement of these trees, should it so happen, that at any time he should require a little money over and above his usual income, he can turn up his wood-book, in which he has the number and measurement, and of course the value, of all his trees ; he can then pick out such a number of trees, and remit these numbers to his forester or manager, with instructions to sell them, and he at the same time strikes them out of the list, and he knows at once the exact sum, or nearly so, he is to receive for such trees ; and, besides, should any tree or number of trees be blown down, or broke, or lose their growth, &c. the forester or wood manager writes, sending a list of the number and measurement of the tree or trees thus blown down,

&c.; he at once turns up his wood-book, and sees the tree or trees, and their value. A book of this kind kept by any proprietor of woods must give universal satisfaction. Having in readiness this instrument for measuring standing timber, which is very easily procured, being so very simple and cheap, he will readily take the dimensions of any tree. Admitting his plantations are all young and thriving, and yearly on the increase, they can very easily and expeditiously be measured over as often as need requires; and should a gentleman require to cut only a few trees from his own woods annually, for purposes on his own estate, when he knows the sizes required, he can easily, before cutting, know the very tree or trees that will suit the various purposes required.

A book ruled on the following plan, would be very advantageous, and must be very satisfactory to landed proprietors having extensive woods come or coming to maturity.

Number of TREES marked off, that should be cut for the Improvement of the Plantations, or that may be cut without injury to the look of the Plantations, with their Measurements and Value.

[illegible]

SECTION XV.

OF PRINCIPAL PIECES OF TIMBER USED IN SHIP-BUILDING.

THE principal pieces of timber used in all kinds of ship-building, whether large or small, are nearly of the same cast or shape, as they

uation of TREES and PLANTATIONS to remain on the Estate, either to be reared up to maturity, or for ornament; also, a Report of their State, with Observations and Directions for their future improvement.

No. of Trees.	Descriptions.	On what Farm, or in what Plantation.	Value.		
			£	s.	d.

are all built of nearly the same mould; but these differ very materially in point of size; for instance, a small vessel of about 40 tons register, will require a keel nearly 40 feet long, and to square about 8 by 11 inches, whereas a vessel of 80 or 100 tons register, will require a keel about 60 feet long, and to square about 10 by 12 inches, and so on, the other timbers in proportion. It is perfectly sufficient for our purpose here, that I inform the forester of the names of a num-

ber of the most particular pieces of timber used in a vessel, and which, when asked for singly, are known to sell highest, and are, on that account, the most valuable.

In order still more to assist the forester in this particular part of his work, I have, in this edition, given engravings descriptive of the curvature requisite for the most principal pieces of timber used in ship-building; which will be seen in the plates; and I have no doubt will be found of the greatest use, both to the proprietor and his forester, in training up and bringing his trees to the highest possible value.

First, there is the outer keel : this is commonly used of beech or elm, and made generally of two or three trees or pieces joined together, to whatever length is required : these are looked for to be nearly straight, and sell generally according to the length of the piece, at 3s. 6d., 4s., and 4s. 6d., and some years ago as high as 5s. per solid or cubic foot. Second, the keel-stone, or inner

keel: this requires trees of nearly the same description, but are chiefly made of oak: these I have often sold as high as 7s. and 7s. 6d. per foot, during the late war.* Third, floor timbers: these are sometimes used of elm and beech, are a little crooked, and generally sell at 2s. 6d. per foot. Fourth, first crooks: these are a good deal crooked towards the one end, as they begin to ascend up the vessel, and are more valuable than the floor timbers; but are also used sometimes of elm and beech, and generally sell,

* Let it be understood, that since the peace, there has so much of beech, elm, black birch, and oak, come in from America, which is applied to the same purposes, that it has greatly reduced the prices of this kind of timber, although it is allowed, on all hands, that the American timber is not near so good. Still it has brought the prices of our timber of that description down 1s. per foot from what it was formerly. But now, in 1824, the deficiency of durability of the American timber to our Scotch or English timber is seen, and our timber is now in demand, and rising in price; and often ship-owners, in contracting for ships, prohibit the using of American timber in any part of the ship. American timber has been known not to last above six or seven years in ships, when used as timbers, and in planks much the same.

when asked for singly, at about 3s. 6d. per cubic foot. Fifth, upright timbers : these are always made of oak, and are considerably crooked, and these sell, when asked for singly, at 3s. 9d. per foot. Let it be here observed, that elm or beech is seldom put into a good vessel, except the lower part, called the floors, where the vessel is always under water when light. Sixth, top timbers : these are also of oak, but not so valuable, as they are mostly straight, and although asked for singly, only bring about 3s. per foot ; keeping in view that the feet used here are solid or cubic feet, line measure, 1-4th of the girth taken for the side of the square. Seventh, beams : these go under the deck of the vessel, and are also oak, and have but a small crook, but require trees of considerable length, and are valuable, say 3s. 6d. and sometimes 4s. per foot. Eighth, knees : these are always of oak, and are the most principal crooks in the vessel ; and when these are asked for singly, they generally bring about 5s. or 6s. per foot,

according to their sizes. I have known ship-builders, in repairing vessels during the time of war, charge 10s. 6d. per foot for knees, and within these two years, charge 7s. 6d. per foot for such. Ninth, stem-piece: this is a very particular crook, and when asked for singly, generally sells at 4s. 6d. and 5s. 6d. per foot. Tenth, breast-hooks: these also have particular crooks, and sell at 4s., 4s. 6d., and 5s. 6d. per foot. Eleventh, stern-posts and windlass, are straight pieces, but when asked for singly, sell at 4s. per foot. Twelfth, trees that will cut up for planking: these are used of as great a length as they can be got, and are the better for having a considerable crook or curve one way: these are used of elm or beech for planking under water, and sell from 3s. to 3s. 6d. per foot; but four planks of oak are required for one of beech or elm for this purpose, and if oak, they commonly sell at 4s. and 4s. 6d. per foot. (See a figure of each of the different crooks in the plate.)

These are the principal pieces of wood used in ship-building, that are of the most value, when asked for singly,—but prices will vary a little, as circumstances or the demand occurs. But when a large promiscuous lot of oak, or any other timber, say large and small, crooked and straight together, is sold to a ship-builder, he generally pays what is called an average price for the whole, say from 2s. 9d. up to 3s. 6d. per foot. It is worthy of observation here, that the most valuable, and by far the greater part of timber used in ship-building, is crooked: it is therefore greatly for the interest of the proprietor that the forester attend to make his trees grow as crooked as possible: for this purpose he may consult Section III. This ought, and I hope is, particularly attended to, in the national forests, and on all proprietors' estates, holding a local situation to the sea.

SECTION XVI.

PRINCIPAL TREES MADE USE OF IN MACHINERY.

SINCE the making of cast and malleable iron came to such a degree of perfection in Britain, it has greatly reduced the quantity of timber demanded for mechanical purposes. The prices of cast and malleable iron have been so low that it is now applied to many purposes in which timber was formerly used : besides, a great many of the large gun carriages, both on board of ships of war and also in land service, were formerly made of the best of oak, elm, and ash, but are now chiefly made of cast and malleable iron.

The principal kinds of timber in use for mechanical purposes are oak, elm, ash, and

planetree.* Oak is used for mill-wheel axle-trees, and, when required for this purpose, must be of a large size, and of good quality ; and a tree for this purpose usually sells as high as from 5s. to 7s. per foot. The arms too of a mill-wheel are sometimes used of oak, elm, or ash, which sell at 4s. and 5s. per foot. The ring of the wheel is sometimes of ash, planetree, or saugh, and when crooked to answer this purpose, generally sells at 3s. and 4s. per foot. The buckets of the wheel are either made of saugh, (which is the best) or of fir. When saugh is asked for this purpose, it generally sells from 2s. 6d. to 3s. 6d. per foot. Whatever inside machinery about a mill is made of wood, it is most commonly of oak, elm, ash, plane, or sometimes beech, and when asked for those purposes, generally sells at from 3s. to 4s. per foot, according

* Notwithstanding the excellent quality of the Spanish chestnut timber, which is equal to the oak in ship-building, and also for any machinery, yet it has not been generally used ; but this tree should be both more planted and more used as timber.

to the largeness of the sizes that are required. Large planetree is often asked for, which is used both in printing and bleaching works, called beetling beams, a kind of tree that was very difficult to be obtained, and often sold at a very high rate. It is necessary this should be a tree that would work to from 18 to 24 inches diameter, and from 12 to 18 feet long, perfectly clean and straight. Trees of this description when asked for singly, always did and will sell at a very high price; for I have often seen paid for them, when bought singly, from 7s. to 8s. per foot. Large planetree is used also for mangle or calender soles. When bought for that purpose, it brings from 3s. 6d. to 4s. 6d. per foot. Planetree is used also about cast iron foundries for making patterns, &c. which sells at from 3s. to 4s. per foot for that purpose. These are the most of the particular kinds of hard wood made use of for machinery, and when asked for singly bring the highest prices.

SECTION XVII.

PRINCIPAL KINDS OF WOOD MADE USE OF IN
CARRIAGES, HUSBANDRY UTENSILS, &c.

UNDER this head we may class waggons, coaches, and carriages of every description, as the same kinds of timber are used in the whole of them.

The principal description of timber used for carriage wheels of every kind, is elm for naves; oak for spokes; ash, elm (and some use beech) for fillies. Elm, when required for coach or carriage wheel naves alone, sells from 3s. 6d. to 4s. 6d. per foot. Spokes are what is generally termed blocked before they are sold, and they are generally blocked out of small oak trees, for which purpose the oak timber of natural coppice wood is remarkably well adapted; and these are used at various lengths and sizes, according to the height and

strength of the wheels. Chaise wheel spokes, long and short taken together, sell at 40s. per long hundred, say 120 to the hundred, or 8s. 6d. per gang, of 26 spokes to a gang. Spokes for common-sized cart wheels sell nearly at the same price, and in the same way : ash and elm for fillies, at 3s. and 3s. 6d. per foot, and beech at 2s. 6d per foot. The principal part of timber that is used in coach-making, and when it is found to answer for poles, perches, or splinter bars, &c. and purchased singly for that purpose, sells at from 4s. to 4s. 6d. per foot.

Ash is chiefly used for plough beams, and cart trams or shafts, and it commonly sells, when asked for that purpose, at about 4s. per foot.

The common carters and carriers in Edinburgh, Leith, Glasgow, Greenock, &c. prefer using for their cart sides or trams young oak trees, such as one whole tree to work into a side or tram ; and when these are got good and suitable for their purpose, a very high

price is paid for them, from 4s. 6d. to 6s. per foot. Larch fir is often used for this purpose, and is found to answer well.

Ash and elm are used for harrow bills; but when large birch wood can be got, capable of being cut into planks for that purpose, it is used in preference, and makes excellent harrows, much better than either ash or elm, as it is of a more tough nature, and not so subject to split either with the drought, or in driving the iron teeth into it, particularly when it is used with the heart in it.

SECTION XVIII.

THE PRINCIPAL KINDS OF WOOD USED BY COOPERS.

SINCE the British Parliament authorized herrings to be put into barrels made from Bri-

tish timber, and gave the same bounty for herrings cured in these barrels, and allowed them to be exported, which formerly was not allowed unless the barrels were made of foreign oak, ever since that time large quantities of elder, birch, and small hard wood of all kinds, have been cut for that purpose; and since circular saws have become so plentiful through this country, which is a most excellent and expeditious method of sawing up small woods, and particularly into herring barrel staves, the prices of small woods for that purpose have become somewhat considerable: hence it is that plantations, many of which are to be met with in the Highlands of Scotland, consisting almost entirely of birch and elder, and which, in former times, were considered of little or no value, and were chiefly cut for fire-wood, have of late been sold for considerable sums of money; and as circular saws require very little machinery to erect and set them agoing, and when a place can be found for them near a plantation of

this kind, it of course enhances the value of the wood very much, because after it is cut up into staves, &c. it becomes very portable, and easily carried to sea-ports, although the plantation should be a considerable way inland, and the brock or brushwood that comes from the saws can be sold to good advantage in an inland country where coal is so scarce and valuable. These circular saws cut up immense quantities. One saw driven by a four horse power, (either by water or otherwise,) when wrought and attended to by two or three men, will cut up one thousand barrel staves each day.* But observe here, that

* See these saws brought to a very great degree of perfection on the estate of Closeburn, the property of C. G. Stewart Men-teath, Esq. Dumfries-shire, where large timber as well as small is cut up with these saws, and to suit all purposes. A. H. Belshes, Esq. of Invermay, Perthshire, has saws of this kind, and many others, who found them extremely useful for many purposes on their estates. I would recommend it to every gentleman who has any quantity of wood, to have one of these saws, as the expense of erecting them is so very trifling, and the advantages of them so very great. Home Drummond, Esq. of Blairdrummond, M. P. erected one very lately, which he found to be of great service to his estate in many respects. On all estates, where wood is the principal object, these saws are of great use, and save a great deal of manual labour.

the 1000 barrel staves are 1200, it being the customary way of selling them by the long hundred. Some will be ready to say that these saws, cutting up such large quantities in one day, when there are now such numbers of them at work in the country, will speedily overstock the market; but let it be here remarked, that the quantities consumed annually are immense. I have it from good authority, that at the port of Leith alone there are used annually of herring barrel staves upwards of *ten hundred thousand*; in Greenock, Port-Glasgow, and Glasgow, as many; the like number about the Western Highland Lochs; Burntisland, Dunbar, and the coast of Fife, including Dundee, an equal number; and in the northern counties, say from Aberdeen to Wick, a great deal more than one million: so that there are no fewer than five millions of staves used annually, which must take an immense quantity of wood; but no small portion of this is made from American hard wood, both at Leith,

Greenock, and Glasgow. As this is an article that is likely to continue in demand, and as birch and elder wood will grow and thrive in marshes, when no other kind of wood will, such gentlemen as have a quantity of land of this description, that cannot be drained to grow oak, would do well to plant it with wood of the above description; and as it grows very rapidly from the newly cut stock, and does not require much care or attention, though to do it justice it should have a little in the same way as the natural oaks, it will be perfectly ready and fit to be cut for stave wood every fifteen, or from that to twenty years, provided always these stools be thinned in like manner with oak. A piece of ground which is hardly fit for any other purpose, may in this way be turned to very good account. There is no danger of the want of demand for staves, while government continues to give the bounty for herrings put into barrels made from British timber. The consumer of staves generally requires that

they should average four inches broad, but they are used from two to six inches broad, and thirty-one inches long, and to stand in the barrel when finished half an inch thick. Staves of the above description, (say in general averaging four inches broad,) sell at the port of Leith, &c. or where they are used, at about L.6 Sterling per thousand. Sixty square or cubic feet of timber will cut into one thousand staves. Wood bought for the purpose of cutting into staves, if near a seaport, where it can be readily carried to a market, sells at 1s. per foot, the purchaser being at the expense of cutting, carriage, &c.

Small planetree is also used by coopers for herring barrel ends, and is very easily cut up for that purpose with the circular saw. When cut for this purpose there is no matter what the length or breadth be, but the thickness must be five-eighths of an inch after being finished in the barrel; and when cut up, and sent to market with the staves, sell at two-pence and two-pence halfpenny per su-

perificial foot, or nine-pence for as much as will make a pair of ends, each to work eighteen inches diameter. When small plane-tree is bought in the woods for this purpose, and when near water-carriage, it sells from 1s. 6d. to 2s. per foot.

As this is a new source of consumption for timber of the above description, I have been the more particular regarding this part of the subject, and I have only to add here, that if our American supplies were shut up, how soon would our home supply be exhausted of this single article, however insignificant it may appear as a species of timber. I do not mean to be understood here as saying, that this kind of timber should be planted in preference to the oak, or other more valuable kinds; but it will grow, and can be reared in land, when no other kinds can, and in all such lands I would recommend it to be planted.

SECTION XIX.

THE CONSUMPTION AND USE OF WILLOW OR OSIER
BY COOPERS.

OF osier, or hoop willows, there are a great many kinds, no less than eighteen; but it is sufficient for my purpose here, that I mention those kinds only that come soonest to maturity, and are fit for making good barrel hoops. For this purpose I need only notice two kinds; first, the common osier, or hoop willow, and secondly, the Huntingdon willow. Both of these two kinds grow excellent hoops; and, if properly managed, are ready to cut alternately for that purpose every three years. Having mentioned in the preceding section the immense quantity of staves made use of in herring barrels alone, it will very

readily occur to every person, that the quantity of hoops used for making up such a number of staves into barrels must be immense, as every barrel takes at least twenty hoops. I have been informed by many of the most respectable of the consumers of this article, both on the east and west coasts, that barrel hoops are for the most part imported from Holland and England, whilst they admit that Scotch hoops are equally as good when they can be got. I have also been informed by some of those gentlemen who have themselves cut some plots of Scotch hoops, that although there were 5000 acres of land in Scotland, all bearing good hoop willow, and these cut alternately every three years, it would not be more than sufficient to supply the annual demand of this country. These hoops, after being split in two, sell in bundles of 120 in each, at from 4s. to 5s. per bundle. This is on an average 4s. 6d. for every 60 round hoops.—What a large quantity of these even a single acre would pro-

duce ! I am informed, there are many acres of hoop willow ground in England that pay an annual rent of L.10 per acre. Some authors go the length of L.30 per acre. I know several pieces of ground in Scotland growing hoop willows, that pay annually a rent of L.9 per acre ; and there is a small barn-yard in Stirlingshire, where there are about 100 stools of hoop willows growing from the side of a useless ditch, which have brought in regularly during the lease from L.4 to L.5 every three years. Sure I am there are many gentlemen in Scotland who have many acres of marshy places, capable of carrying hoop willows, for which I believe they draw little or nothing. These keep a gardener or forester, and they might, with very little trouble, turn a few acres, or even half an acre less or more to very good account in this way, as it requires very little management after being once planted. A few years ago, Hugh Baird, Esq. engineer, proposed to the proprietors of the Forth and Clyde canal navigation, to have

some parts of the canal banks planted with hoop willows, which went on prosperously for some years by the direction of that indefatigable gentleman, particularly that part of the canal bank called the Bog, which is well adapted for that purpose ; and had it been properly managed, would have been a considerable source of revenue, besides beautifying the banks, which I am sorry to see now in a state of total neglect. The late Right Hon. Lord Viscount Keith had a great number of acres of wet land on his estate of Tulliallan, which, if he had been spared, he intended to convert it into willow land. I hope his Lordship's successors will find it their interest to do it. Tenants of farms would do well to attend to this when they have land for the purpose, as no kind of crop will pay them better. To encourage them to it, I insert the opinions of the ancients on this subject.

*Of the Culture of Willows, from some very
Ancient Authors.*

WHEREVER there are vineyards, there is a great demand for willows. They were used by the ancients for binding the vines to the trees that supported them, and for making all sorts of baskets used in the vineyard. Cato, after directing in what manner to plant reeds, adds, “ Plant the Greek willow around the reed field, that so there may be twigs for tying the vines.” Varro expresses himself to the same purpose. A jugerum of willows was reckoned sufficient for twenty-five jugera of vines ; but willows were necessary, not only in the vineyards, but also in the olive yards. This Cato directs that willows be gathered in time to make baskets for the olives. A crop of willows was reckoned so valuable in the time of Cato, that he ranks the willow field next in value to the vineyard and garden. With respect to the culture of the willow,

he says only that it should be planted in low marshy and shadowy places, near to rivers.

Columella and Pliny treat more particularly of this subject. "The most proper land for the willow," says Columella, "is that which may be watered, or is naturally wet; however, rich land lying flat answers very well." These ancients reckon three principal kinds, which they denominate the Greek, the Gallic, and the Sabine. "Of these," say they, "either tops or cuttings are planted: cuttings one and one half foot long are planted, pushed down as far as the solid earth, and covered over a little." "The time of planting is before the buds come out; the branches to be used should be taken from the trees when dry, for if they are cut when wet with dew, they do not succeed well; for the same reason, neither are they to be lopped on rainy days. Unless great care is taken, many of the willows die when newly planted. In the room of these that die, others ought to be

propagated by layers from the nearest plants : these are made by bending the tops of the branches, and fixing them in the ground ; in this manner the places of those that die are supplied. The layer, when a year old, may be cut from the stock, as then, like a vine treated in the same manner, it may be nourished by its own roots." So far does Columella go even in the nature of layering, which seems to have been practised amongst the ancients.

The same author, after treating of the culture of broom, which was used for the same purposes with the twigs of willows, adds, " The willow for poles requires much the same kind of soil with the willow for twigs ; the best kind," says he, " is a field that may be watered ; it is planted by branches, and when it buds, is trained up to a pole." Pliny, treating of the subject, expresses himself in this manner : " Of the things planted for the benefit of the vines, the willow holds the first place ; it is planted in moist land, digged two

and one half feet deep, by twigs or rods, one and one half foot long, the larger the more useful. The intervals between the rows should be six feet wide ; when three years old they should be cut within two feet of the ground, that so they may spread to the breadth, and be cut down without ladders ; for the willow is the more fruitful the nearer it grows to the earth. It is necessary that these be digged about every year, in the month of April. This is the culture of willows when designed for twigs. When they are intended for poles, let twigs or rods be planted upon land prepared in the same manner, and poles may be cut from them in the fourth year. Such as die may be replaced by layers from the old stocks, a branch being put into the ground, and after a year cut from the old root."

Here are two clear proofs of layering, and that too recommended by these two ancient authors. It appears that they were in the

practice of layering from the branches of trees ; and if it succeeds from a branch of a tree, of which I have seen many undeniable proofs, it is much more rational and natural to suppose that it will succeed much better from the main leading shoots of the roots. None need be the least afraid of putting this plan into practice, for they will be sure to succeed, and that too beyond their expectation, with the kinds advised in the section on planting.

Let us hear what Mr. Dickson, in his excellent book on Husbandry, says on the cultivation of willows. “ There is not,” says this author, only taking the use of willows for vineyards, “ so great a demand for willows in Britain as in Italy, and other places, where there are vineyards ; however, the demand for them is greater than can be at present supplied ; at least it is so in many parts of the kingdom. We have many low, wet, and marshy lands, very fit for raising them, and which, in their present situation, are of very

little or no value. These may be very properly applied to this purpose. Such of our farmers as attempt to raise them, are far from being so careful in the culture of them as the ancient Roman farmers were. This possibly may be the reason that there are not such profits from the crop as to encourage them to proceed. But were they to imitate the Roman farmers—prepare the land for being planted, by trenching it two and one half feet deep; carefully dig around the plants after they are set, and keep them free from all kinds of weeds, they would have good reason to expect a very good, and if in a convenient part of the country, a very valuable crop.” I have often been much surprised, that many farmers, whose farms to my knowledge contain from one to ten acres of land fit for this purpose, do not plant and attend to them in the foresaid manner, as it would pay one year’s rent of their whole farms every three years, and that from land which, in its present state, does not pay them 5s. per acre. This is sluggishness with a witness !

SECTION XX.

THE PRINCIPAL KINDS OF HARD WOOD MADE USE OF
BY CABINET-MAKERS.

THE principal kind of hard wood made use of by cabinet-makers is mahogany ; but they sometimes make use of elm for chairs, beech for bedstead framing, planetree for common tables, and Spanish chesnut for boxing, drawers, &c. in the room of wainscot, holly, and sometimes limetree for inlaying. Elm, for chairs, generally sells at 3s. per foot ; beech, for bedsteads, at 2s. 6d. ; planetree, if large, for tables, at 3s. and 3s. 6d. per foot ; Spanish chesnut, for boxing, at 2s. 6d. per foot ; though Spanish chesnut is of much more value when suitable for ship building, as it is often used for that purpose ; holly, for inlay-

ing, 2s. 6d. per foot. Planetree is also used by block-makers, and sells, for their purposes, at 2s. 9d. The carvers and gilders use chiefly limetree, for picture and glass frames, and generally buy it for this purpose at 2s. 6d. per foot. Turners use chiefly beech, birch, planetree, box, holly, &c.—Beech, for their purposes, sells at 2s. ; birch, at 2s. 6d. ; planetree, 2s. 6d. ; and box and holly, at 4s. per foot. Lock-smiths use chiefly beech and planetree, of which they use great quantities for lock stocks, which they buy at 2s. 6d. per foot. Last-makers use always beech for lasts, and buy it at 2s. They were accustomed to use birch for heels and patten stocks, when they were required, and bought it for that purpose at 2s. per foot. Large quantities of American black birch, and other kinds of American hard wood, has been adopted by cabinet-makers and other tradesmen, for many of the purposes mentioned, which has both lessened the value and demand for the hard wood of this country.

SECTION XXI.

OF THE WILLOW TREE, OR SAUGH.

THIS saugh wood is used in large quantities about cast-iron founderies, and particularly about coal or lime works, for cutting up into boards for cleading waggons, barrows, coal buckets, &c. used below and at the coal pit mouth ; and is very well adapted for this purpose, on account of its tough nature, as it is by no means apt to splinter from the stroke of the sharp corner of a piece of coal or limestone, like any kind of fir timber : hence large quantities are used for that purpose. For the above purposes, either red or white poplar, or any kind of saugh, is used, when it is of size to cut up into boards. When near a sea-port, so that it can be easily

conveyed to public works, it sells at from 1s. 6d. to 2s. 4d. per foot. Sometimes lime-tree is also used for this purpose, and generally sells at the same price.

It would be an endless task to mention every article that hard wood is applied to—but what has been mentioned is the most general and particular purposes; and when asked for, agreeably to the foregoing designations, will bring the prices mentioned in almost any place in Scotland, with very little variation, except in cases where a person is desirous of a particular tree: in this instance it may bring a price higher than any mentioned. The willow tree, or saugh, when crooked so as to answer for what is called strouds for the water wheels of mills, sells well, and is always in good demand, as it stands the wear in water better than any other kind of wood. It is generally used for the boards of the paddles, as they are called, in steam-vessels.

SECTION XXII.

AVERAGE PRICES OF HARD WOOD.

I SHALL now enter upon what may be considered as the average prices of hard wood for the years 1817, 1818, 1819, and the spring of 1820, up to 1824, at the ports of Leith, Glasgow, Greenock, Perth, Dundee, and Aberdeen, taking whole cargoes, from six inches in the side of the square, line, or girth measure, and supposing the average square girth of every cargo and kind not less than ten inches, and the quality good. Here let the reader always keep in view, that the prices mentioned are for the solid or cubic foot of round timber, line measure, and one-fourth of the girth taken for the side of the square, after deducting an allowance for bark.

This observation on his part is the more necessary, as all English oak, or other hard woods, brought to any of the above ports, are all sided or squared a little, and sold by the calliper measure, taking the diameter of the piece for the square, which makes a very considerable difference in the measure, and of course in the price ; but in this case we proceed by the line measure, according to Hopus, as the standard measure of all kinds of timber, as I have done all along.

Average Prices at the Port

OF LEITH.

	Per foot.		When particularly good.	
	s.	d.	s.	d.
Oak, ...	3	6	and 4	6
Ash, ...	3	0	3	6
Elm, ...	3	0	4	0
Planetree, ...	2	9	3	3
Beech, ...	2	0	2	4
Spanish chesnut, ...	3	0	4	0
Walnut, ...	3	6	4	6
Cherry or gean, ...	2	0	2	6
Saugh, ...	2	0	2	9
Birch and alder, ...	1	6	—	—
Hornbeam and laburnum, ...	2	3	—	—

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AT GLASGOW.

	Per foot.		When particularly good.	
	s.	d.	s.	d.
Oak,*	4	6	and 5	0
Ash,	3	6	4	6
Elm,	3	3	4	6
Planetree,	3	6	4	6
Beech,	2	0	2	9
Spanish chesnut,	3	0	3	6
Walnut,	3	5	4	0
Cherry or gean,	2	0	2	9
Saugh,	2	8	3	3
Birch,	1	0	2	0
Alder,	1	6	—	—
Hornbeam and laburnum,	2	6	—	—

AT GREENOCK.

Oak,	3	6	4	0
Ash,	3	4	3	9
Elm,	3	2	3	6
Planetree,	3	3	3	9
Beech,	2	2	2	6
Spanish chesnut,	3	0	4	0
Saugh,	2	4	2	6
Birch and alder,	1	8	—	—

AT PERTH.

Oak,	2	0	3	0
Ash and elm,	2	9	3	0
Planetree,	2	6	3	0

* Let it be kept in view, that there is scarcely any oak sent hither for ship-building, but chiefly for machinery ; and, consequently, it sells higher when suitable for that purpose.

	Per foot.		When particularly good.	
	s.	d.	s.	d.
Spanish chesnut,	2	6	and 3	0
Beech,	1	10	2	0
Gean,	2	0	—	—
Birch and alder,	1	0	—	—

AT DUNDEE.

Oak,	3	6	4	0
Ash,	3	0	3	6
Elm,	2	9	3	6
Planetree,	2	6	3	0
Beech,	1	10	2	3
Spanish chesnut,	2	6	3	0
Saugh,	2	4	2	6
Birch and alder,	1	2½	—	—

AT ABERDEEN.

Oak,	3	6	4	0
Ash,	3	9	4	0
Elm,	3	6	4	6
Beech,	3	0	3	6
Planetree,	3	3	3	6
Beech and alder,	2	0	—	—
Cherry or gean,	2	6	—	—

Let it be observed, that these are the prices when a complete cargo or large quantity is taken, but when sold by retail, or in small portions, they bring a much higher price.

The average of all kinds of timber was much higher, at least a shilling per foot, at all these places, during the late war, compared with what they are now. The prices are now, in 1824, much better than they have been for a number of years past.

SECTION XXIII.

ON THE PURPOSES TO WHICH SCOTCH FIR TIMBER MAY BE APPLIED.

WERE the common Scotch fir, which is so congenial to the soil and climate of this country, permitted to arrive at the same age with foreign timber of the same kind, it would prove in every respect equally valuable. Were the Scotch fir allowed to stand on the ground for a hundred years or thereby, it would be equally durable, and fit for the same purpo-

ses as Norway or Memel fir; which I have learned from experience. Allow me to give the reader a single instance, which I trust will justify the above remark.

In the year 1795, at the request of the owner of a house in Bannockburn, Stirlingshire, I made some window sashes for his house from the common Scotch fir, being the wood of some old trees which I had cut from the estate of Auchenbowie, in the same county. For the same house, and at the same period, I made some sashes from the best Gottenburgh deal then imported. These sashes were put into oak cases or frames, where they at present stand, (1824,) being 28 years of age. The Scotch fir sashes looked as well at the time they were put in, and do to this day, and appear to be equally durable, as those made from the foreign deal. There was also made in the same year, and from the same Scottish fir timber, several bound doors, which can be seen at this day without any paint, equally as fresh looking

as when made. I was told the age of those trees did not exceed eighty years. The root cuts of them were remarkably clean and free from knots or blemishes, for 12 and some of them for 18 feet from the root, excepting in a few cases, where the branches had been allowed to rot and fall off, which, in some instances, left a loose knot or a hole, which made a very considerable blemish in the board after being cut up. These trees had never been known to be pruned. It is therefore absolutely necessary, and most essential to the value of common Scotch fir trees, that, as soon as the branches begin to die, or to show symptoms of decay, they be pruned off close to the bole or main body of the tree. It is perfectly evident, that the fine fir logs imported from Memel are never pruned, and that the branches are allowed to rot off them, since it is a fact well known to the workers of Memel timber, that when a coarse knotty log is cut up, if it does not immediately show a hole in the board, the knots are always

ready to fall out on the least pressure when among the hands of the workman, and however cautiously he makes the plane go over them, they are apt to get loose, and must be put in with glue, and are never firm.

In the summer of 1818, I was asked to accompany a gentleman of Dundee on board a vessel direct from Norway, loaded with fir battens, which he wished to purchase. Accordingly I went on board, and, after turning over a great many that were on deck, I found they were extremely coarse, indeed more so than any of the kind I had ever seen before. I told the master of the vessel, who was also the merchant, that they were really as coarse as our Scotch fir ; and I asked him the reason of their being so knotty, but he at this time declined to give me any reason ; and the gentleman whom I had accompanied declining to buy them, we left the vessel. After we had got a considerable way up the quay from the vessel, the Norwegian captain followed, gave me a tap on the shoulder, and

said he would wish to see me in the afternoon. I then began to suspect that the battens had come from some port in the north of Scotland, and, to ascertain the fact, I was anxious to have a conversation with him. Accordingly I attended at the time, and entered into a conversation with the man, whom I found to be very intelligent. Before he answered me any question, he asked me what line of business I was in ? I told him I was a wood-cutter. "That," said the Norwegian, "was my father's trade, and likewise my own in the early part of my life." I now considered myself as very fortunate in having fallen in with one who could give me some information as to the woods in Norway, which are so much superior in quality to our Scotch fir woods.

In the first place, I inquired as to his battens. I am afraid, said he, you will hurt the sale of them. I assured him I would not, and told him I only wanted a little information as to how they managed their growing

woods in Norway, and that if there was any thing new or very beneficial to be learned as to the nursing up of woods in Norway, I would go out a little and try to learn it. He smiled, and said that I would in that case be disappointed, as they had no way of managing the wood in Norway but cutting, squaring, and sawing, &c. As to the battens you saw on board, and which I know are not good, I shall explain. I have a brother in a seaport in Norway, who is a merchant; and he and I are in company: this brig is our own; and while I sail her he stays at home, and makes bargains of wood, bark, or any thing he can buy up. It is my business to take them to England or Scotland and sell them, and take back goods for them. My brother bought these battens from a man who had purchased a large quantity of wood that grew in such a place that it was hardly possible to get it out. The wood was but young, only between thirty and forty years old, and it was very thin upon the ground, and was branch-

ed down to the very root ; this made the battens so very coarse and knotty ; and, continued he, my brother bought them at a very low price, as no other person would take them. I here remarked to him, that as these fir trees were so very coarse and knotty when young, how came it to pass that I saw a great many small spars brought from Norway, some of which he had on the deck of the vessel from twenty to thirty feet long, very small, and perfectly straight, and scarcely a knot to be seen on them from end to end ? I also asked how it happened that boat oars were made from small Norway trees ; and of these spars and oars I had seen great numbers come from Norway. Hold, hold ! says the Norwegian, these spars and oars are not got amongst the young woods at all, but grow among the largest and oldest of our woods. These, says he, are all plants, (which we call seedlings,) and are always to be found where the wood is closest, and very often grow close by the side of a large tree. They grow very tall and

small, and there is no room for the growth of branches ; and some of these may be of great age although small. I then took up a spar, and showed him it was all white wood ; I took up another, and showed him it was all red wood ; and I also showed him there was a great difference in the barks of these two spars, and said I conceived them to be two different species of fir trees, and that both of these were a different kind of tree from what the battens were cut from. He said the white wood spar was a different kind of fir tree, but the other spar was the same kind with the battens. I could not help differing from him on this point, as I was certain the battens were cut from what we call our common Scotch fir. I then asked him if he ever had been in any of our woods in Scotland ? He said, never. I then asked him if he thought he could tell me, if I were to carry him to a plantation in the neighbourhood, if the species of trees were the same as in Norway ? He said he could do so with perfect ease. As I

was extremely anxious to know this, I told him I would take it exceedingly kind of him, if next day he would accompany me a few miles into the country, when I could show him all the different species of fir, and have his opinion. The obliging Norwegian instantly agreed, and we set off next morning by seven o'clock for the estate of Fotheringham, about eleven miles north of Dundee, where I was at the time employed in cutting oak wood. Here I had an opportunity of showing him all the different sorts of fir wood trees which are reared in this country. From him I found, to my entire satisfaction, that the best kind of fir wood in Norway is of the same species as our common Scotch fir. One of his spars was larch, yet he allowed it differed a little from ours. The other spar was the same as our spruce fir, which, he says, grows in vast abundance in Norway, and answers to their white wood, or pine fir, which they export hither. I then asked him if ever they pruned any of their fir woods? He

smiled, and said “ Never, that would be impossible, from their extent ;” but he added, “ that they sometimes thinned them, but even that was not done to any great extent.” I had some conversation with him respecting oak bark and barking ; but this will come under another head. From all this, and my own experience, I am of opinion that fir timber could be reared in this country that might in time supply all our demand, both as to quantity and quality, equal to any which is imported.

I requested of my Norwegian friend to bring with him, the next time he came to Scotland, a branch, with some of the cones on it, from all the different species of fir trees he could procure in his country, and then I would be a better judge ; which he readily agreed to do : but I have never as yet heard any thing more of him ; yet I do not doubt that he will fulfil his promise.

The average prices of all kinds of fir which grow in Scotland, with the exception of the

larch, which is considered the most valuable, and the Weymouth pine, which is considered the least valuable. When sent to the ports of Leith, Glasgow, &c. if fit for roofing, or for cutting into boards for house carpenters, it has been 1s. 6d. per foot, for the last three years, line measure, and about the same price when sent to any of the coal or lime works, where great quantities of that kind of wood are used. A great number of small young fir trees are used about coal works for what is called pit wood, and when sent to Sunderland or Newcastle, it sells at 7s. 6d. or any part in Scotland where it is used, at 6s. 6d. per hundred lineal or running feet, which must stand four inches diameter at the small end.

The spruce fir, or pine, as it is called in Norway, and by many in this country, is a much better timber tree than what many consider it to be ; for, although appearing very knotty and coarse, when cut up into boards it is a most useful kind of wood, and makes most excellent plain doors, flooring, or scant-

lings ; and, although cut up into thin boards, it neither casts nor twists in the same degree as the other kinds do, although the reverse is generally dreaded. This tree is esteemed of great value by the Norwegians, as also the silver fir, both of which are well worthy of being reared in this country, but especially the spruce, as it grows very fast, and in wet soils where no other of the fir tribe will grow ; and, although used at the age of 40 years, is equally durable as at the age of 80.

SECTION XXIV.

ON THE LARCH FIR, ITS PURPOSES AND VALUE.

OF all fir trees the larch is esteemed the most valuable ; and we have daily proofs before us that no tree advances so quickly in its

growth. Almost all authors agree, that it not only thrives in the poorest soils, but it also grows to a prodigious height and magnitude; and that its wood is much esteemed by every person who is the least acquainted with it for its great durability. That it possesses an astonishing degree of incorruptibility in the open air, or under water, is not to be doubted. This fact is demonstrated by the history of the city of Venice, the greater part of which is said to have been built upon piles of larch fir wood, which are not only still fresh, although they have remained there for many hundreds of years, but they have also acquired such a degree of hardness as in some measure to resemble iron, so as to resist the edge of the best tempered tool. Let it only for a moment be considered how useful a wood, possessed of these valuable properties, might be to a country such as Britain, which depends so much upon its navy for its preservation, and particularly as it promises to be a ready substitute for the oak.

Indeed, for certain purposes, it would seem to be more valuable.

Although the straightness of the larch does not make it suitable for knees in ship-building, yet it could be made to grow crooked for ribs; but supposing it were taken for outward planking, it might perhaps be more valuable for that purpose than the oak, as it would be much lighter and more tough, and possibly may resist the worms better in warm climates; at any rate, it would not be so apt to splinter from shot during the time of an engagement, which would doubtless be the means of saving useful lives that are not unfrequently lost by the splinters of the oak. Connected with the properties which have been mentioned, we ought to remember that as it is of much quicker growth, the nation could much more easily supply their demands with this kind of timber than with oak; all which considerations should make it meet the attention of every landholder who is a

sincere friend to his country and his own interest.

The larch wood too is reckoned of such a quality as, compared with every other wood, to resist the fire in a superior degree, so as only to consume slowly in the midst of intense heat.

The inhabitants of Italy prize this tree very much. Besides using the timber for all valuable purposes, they use the bark for tanning leather; and, from the body of it, while growing, they extract that resinous balsam commonly known by the name of Venice turpentine, which yields the country a very considerable revenue. The profits arising from it must be considerable; it being generally computed that a vigorous larch tree will yield seven or eight pounds of turpentine every year for forty or fifty years, and the usual selling price of this resin, I am informed, is about 6d. per pound: but supposing it were only 2d. or $2\frac{1}{2}$ d. per pound, the annual produce at the above rate, would

amount to at least 1s. 6d. per tree. A Scotch acre contains 500 trees, at the distance of between 10 and 11 feet from one another; at which rate the annual produce of each acre would be L.37, 10s.

The larch fir tree, besides being excellent for ship-building, is supremely well adapted for all sorts of house carpentry, such as joists, roofing, flooring, and also bound work. Workmen, however, object to it, on account of its being so remarkably ill to season, as it is almost impossible to keep it from bending and twisting; so much so that most tradesmen say it is altogether impossible to make a straight piece of work from it; also that it is so very hard when seasoned, as to make it very difficult to smooth with the plane. Many schemes have been tried to cure this evil, when cut up into thin boards or spars. Some adopt the method of steeping it, whilst in the log, in water for twelve months, and then take it out, and dry it properly before cutting up. In

this case, it takes twelve months more to dry after it comes out of the water.

The following is the most efficient method that I could discover for seasoning larch wood, and I tried many different plans before I fell upon it ; but this, experience has taught me, answers the purpose most effectually : In the summer of 1815 and 1816, I was employed to thin some plantations for James Johnstone, Esq. of Alva, on his estate of Denovan ; and also in the same years, for Thomas Spottiswoode, Esq. of Dunnipace. The trees on both estates were of considerable size, and particularly those on the estate of Dunnipace—many of them containing betwixt thirty and forty solid feet of timber. As part of the trees on both estates were to be used by the proprietors for their own purposes, I had, the year before, cut down and barked a considerable number of larch fir trees ; which, being barked after being cut down, and exposed to the summer's sun, rent in such a manner as to render them of

little or no use. To prevent this in future, if possible, I barked all the larch trees standing, and allowed them to remain in this state till autumn, which effectually prevented them from rending with the sun or drought. A number of the trees on Dunnipace estate stood in this peeled state for two summers, and were then cut up; and Mr. Spottiswoode caused his carpenter to make from the timber of these trees some bound doors, which made an excellent job, no part of the wood casting or twisting, and which may still be seen in the porter's lodge, at the eastern approach to Dunnipace house. Since that time I have myself used, and have frequently seen used by others, the timber of larch fir trees, after having stood twelve months with the bark taken off, then cut down, and immediately cut up into battens for flooring, and also made into bound doors and windows for the better sort of houses, with equal success. This is a clear proof that the plan of

taking off the bark from the larch fir trees, some time previous to their being cut down, will not only prevent the timber from shrinking and twisting, but I am of opinion that it has also a tendency to harden the timber, and make it more durable, as it gradually throws out the resinous substance to the surface, and causing it, in a greater or less degree, to circulate through the whole timber; and this in so particular a manner, that the white wood of the tree is found equally as hard, and becomes as durable as the red wood. The consequence has been, that I am now decidedly of opinion, that the timber of a larch fir tree treated in this way, at thirty years of age, will be found equally durable with a tree cut down at the age of fifty years, treated in the ordinary way.

From all that has been stated, I now beg permission to say, that I am confident fir timber could be reared in this country to answer all the purposes that fir wood is required for, and that we might make ourselves quite in-

dependent of foreign countries for a supply of all kinds of fir timber.

The average price of larch fir timber, when sent to the ports of Leith, Glasgow, &c. when of sizes fit for cutting up into roofing, joisting, or flooring, is about two shillings or two and threepence per foot; but would fetch much higher prices from the tradesman if its qualities were better known; observing always, that all larch fir trees, when of size to be used for any of the aforesaid purposes, should be peeled standing, and allowed to remain standing, barked for one whole year at least. The method of barking them standing is simple and easy. See it explained more fully in the figure of peeling larch trees.

SECTION XXV.

OF THE USES AND VALUE OF SMALL HARD WOOD.

WHEN hard wood trees of any description are sold by the solid cubic foot, when standing, the customary way of calculating the timber is by measuring the whole, with all branches, except such branches as do not exceed six inches diameter, or four inches and a half on the side ; for, if the purchaser is at the expense of cutting the trees down, &c. he is generally allowed all the wood of inferior branches to meet his expenses. When the branches of trees or young hard wood, under the above sizes, are sold by the foot, they are sold at an inferior or reduced price ; and when young trees, or even the branches of large trees, are sold in this way—say for barrel staves, &c. as in Section XVI.—they are measured down as low as two and a half inches on the side of the square.

All the brush of hard wood under the sizes stated, or what may even be above it, if it is not fit for any other purpose, is sold by the ton weight. There are large quantities of this kind of wood to be met with in the cutting of coppice wood, cut at the age of from fifteen to twenty-five years, and which is termed ton wood. It is much used for the purpose of extracting, or, as it is generally termed, distilling from it a liquid which is used at bleachfields and calico print works, and now for making vinegar. When wood of this description is sent to Glasgow, where there are extensive works for the purpose of distilling it, it sells readily at from L.1, 2s. to L.1, 10s. per ton ; but when there are large cuttings, particularly of young woods, it is worth while to erect boilers near the wood to distil it, as these boilers can be erected at no great expense ; and, in this case, the liquid is easily carried in casks to where it is consumed, at less expense than the rough timber could be ; of course, it will pay much

better. Small wood of this description is also used for charcoal ; but, in distilling it, there is part of it made into charcoal, which will supply the demand of that article ; so that it is by far the most profitable way, when there is any great quantity to dispose of, to erect boilers and distil it ; unless where the local situation of the wood will admit of it being shipped at a small expense, and carried to where the works mentioned are carried on.

All kinds of wood will give the extract in question, excepting fir ; but oak, ash, Spanish chesnut, and birch, are the best. In many parts of the Highlands this ton or brush wood is used for fuel ; and where there is no coal to be had but at a great expense, it will sometimes be found to pay better to sell it as firewood than to dispose of it in any other way. Oak coppice wood also furnishes great quantities of spoke wood, which is likewise considered under the size of measurable timber. These are cut for chaise-wheel spokes :

long spokes are from 30 to 32 inches by $3\frac{1}{2}$ inches broad, and $1\frac{1}{2}$ inch thick, and the short ones for the same purpose, from 22 to 34 inches long, and same size otherwise ; cart-wheel spokes, from 26 to 28 inches long, 4 inches broad by 2 thick. These are the sizes they require to stand when rough-blocked from the axe ; and, in this way, they are sold at the prices as in Section XVII.

As these spokes must not have the heart of the tree in them, they are, after being cross cut to the proper length, either split through the middle with an axe, or cut with a saw, and are most generally made from the cleanest of the wood. Small wood, when sold by the solid or cubic foot, for spokes, sells at two shillings per foot, and is measured down to three inches on the side of the square. When charcoal is principally wanted, the method of burning it is the following :

To burn it in a smothered fire, a hearth of from twelve to twenty feet in diameter is

prepared on a convenient spot, to which the wood is brought, cut into lengths of from eighteen inches to three feet. These are piled into a proper form, an aperture being preserved in the middle, all along from bottom to top. The billets are disposed around it in directions alternately horizontal and perpendicular, inclined to the centre till the mass be brought to a height of six or eight feet, and gradually drawn in towards the top in form of a cone. If the wood is very green or wet, the interstices must be filled up as the building goes on with dry birch wood, or some such thing, so as the whole will stand compact and firm ; and having done so, the whole must be coated over with turf, to which is sometimes added a covering of fine mould, or a mixture of that with charcoal dust.

The stack is to be set on fire, by throwing into the void space in the centre some pieces of charcoal, or of any dry wood, with some live coals ; and these may be added till the

whole wood round the middle aperture is ignited ; then stop up that chimney, though not so closely but that the smoke may continue to issue from it. At the same time vents must be opened in other parts of the pile, which are to be shut in their turn also, and others opened ; and so on successively during the whole progress of the operation, that there may be always a sufficient supply of external air to keep alive the burning, and that it may go on briskly in all parts of the pile for two, three, or more days. According as the wood is more or less green, will this care require to be continued, till the thick and gross clouds of smoke have disappeared, and the flames no longer issue with impetuosity through the vents, when it is judged that the wood is fully charred. The spiracles are then to be all closed up very exactly with a mixture of earth and charcoal dust, when the fire will go out by degrees : for which purpose, a sufficient time having been allowed, the covering may be taken off,

and the charcoal will be found ready for use. Some little differences may occur in the manner of conducting this process. The best way is to employ persons who have been accustomed to the like work. Charcoal is found to vary in its qualities, retaining generally something in common with the substances respectively from which it has been formed. According to these characteristic distinctions, it is in request for different purposes. Thus, for the making of gunpowder, &c. the coals of alder, birch, willow, hazel, and lime, are considered the most suitable ; and for the reduction of the metallic calces, those of the heavier woods, as the oak and beech, are preferred ; and all of these kinds are considered of best quality when used without the bark, and bring from twenty to forty shillings more per ton at foundries and powder-works, and have been selling for some time back, when delivered at these works, at from L.3, 10s. to L.6 per ton.

SECTION XXVI.

OF THE BARK OF TREES THAT MAY BE USED, AND IS MOST GENERALLY USED IN TANNING, WITH ITS VALUE.

I HAVE been informed, that a great many different kinds of bark are used in the dying of cloths ; but with this I am not sufficiently acquainted. I shall therefore confine myself to those kinds which are, or might be, used for tanning leather, as this is the only sort of manufactory that consumes it to any great extent. Those trees, whose bark is universally used for tanning, are the oak, the Spanish chesnut, the birch, the larch, and the rowan tree. The average prices of these different kinds for the years 1817, 1818, and 1819, and adding the different prices in all the shires in Scotland together for that pe-

riod, taking the medium for the average, stand as follows :—

Best Scotch oak bark, commonly known by the name of high-land coppice bark, per ton,*	L.14	15	4
Spanish chesnut, do. per do.	12	10	0
Birch, do. per do.	7	10	0
Rowan tree, do. per do.	7	7	0
Larch fir, do. per do.	7	0	0

Average prices of bark for the years 1821, 1822, 1823.

Best oak per ton,	L.12	17	4
Spanish chesnut,	9	15	0
Birch,	6	6	0
Rowan tree,	5	0	0
Larch fir,	5	5	0

The oak bark of full grown, or old oak trees, as it is generally very corky, sells L.2 and sometimes L.2, 10s. per ton lower than the young or coppice oak bark.—All the above different kinds of bark during the late war, were at least four pounds per ton higher in price than the above statement.

* The prices here stated are given upon the supposition that the bark is delivered at the tan-yard in any county town, or at a sea-port near the works.

As it is agreed on by all, that the bark of oak and other trees in general is only useful in tanning, on account of its astringent quality, which has the effect of contracting the pores of the leather, so as to resist moisture, whilst at the same time it tends much to the preservation of the leather ; we may therefore naturally conclude that the bark of any tree, or even of any vegetable, that is possessed of an astringent quality, will be of use in this respect, proportionally to its degree of astringency ; but this is a quality for which the bark of trees in general is more particularly remarkable, as there are very few trees which do not possess it either in a greater or a less degree. With the view, therefore, of discovering the degree of astringent qualities the bark of every kind of tree possesses, and to compare it with that of the oak, which would show at once the comparative value of each, I applied to a medical gentleman, conversant with chemistry, to inform me how I could best arrive at the object I had in view. He

had little hesitation in saying he could point out an effectual method. His plan was, by taking an equal quantity of the liquor of each kind of bark, and the same quantity of oak bark liquor, and putting them into transparent glass vessels of the same size and form. This being done with each of the glasses, there should be permitted to fall a drop or two, according to the quantity of liquor, of the solution of green vitriol. By this means will be seen which of the liquids possesses in the highest degree the quality of astringency, as the liquor will immediately change to a bluish colour. The deepness of the hue or tinge each takes, points out the proportion of astringency belonging to each.

This trial I made by taking a small quantity of dried oak bark, and an equal quantity of the kinds after mentioned ; I steeped them separately in an equal quantity of water for three months, stirring them frequently. I also tried the same, by boiling each kind, putting the decoction of each into a glass, and putting

into them the same quantity of vitriol ; and on trying them in this way, the degree of astringency was as follows :—

1. The oak struck a deeper tinge than any of the others.

2. The ash and hornbeam. These two were nearly equal, and very little inferior to the oak.

3. The Spanish chesnut, nearly equal to the oak.

4. The green willow, the bay-leaved willow, the common hoop willow, the gray willow, and the Huntingdon willow, were all nearly alike, but all a degree fainter than even the chesnut.

5. The birch and the beech a considerable degree weaker than the Spanish chesnut, and not nearly equal to the ash.

6. The rowan tree, or mountain ash, a great deal inferior even to the birch, and also to the willows.

7. The common broom, when taking the bark alone, nearly equal to the oak ; but

when taking the small twigs, and chopping it along with the bark, only equal to the rowan tree.

8. The laburnum, a degree weaker than the rowan tree.

9. The larch fir, equal to the birch.

10. The spruce and silver fir, a degree weaker than the larch.

11. The common Scotch fir, a small degree of astringency, but much weaker than any of the other firs.

12. The bramble bush, taking bark and all boiled, equal to the chesnut.

13. The saw dust of the oak timber, when boiled, equal to the chesnut, and very little inferior to the ash bark when steeped.

14. The small brush of the tops of oak trees, chopped small and boiled, equal to the ash.

All these kinds, as they possess a considerable degree of astringency, will tan leather; but the beech bark is so very thin, and so difficult to be separated from the tree,

that it can scarcely be obtained ; nor would the bark of the laburnum be worth while. The ash, when it is reared in any quantities, in natural woods, could be very easily peeled without much injury to the timber when it is small ; but when the tree is large, it would injure the timber very much to take the bark off it. But when ash bark can be obtained, it will be found very little inferior to the oak, and stronger than either the birch or the larch, which is in general used.

I also tried the plant called the dock, which is to be found almost every where in great quantities. Its astringent quality is of nearly the same strength as the broom. I therefore think the common broom, the bramble, and the dock, might be good substitutes for the bark of trees in tanning leather ; but granting these substitutes should ever be resorted to in place of the bark of the oak, or any other tree, it will not much lessen the value of the timber. To convince the reader of this, he will please look back to

Section XI. where the value of the foot of oak timber is placed at 4s. ; and considering the sizes of the trees there mentioned, there is only about 6d. per foot reckoned on the bark.

SECTION XXVII.

THE METHOD OF VALUING AND ASCERTAINING THE
QUANTITY OF BARK, &c. ON AN OAK COPPICE
WOOD.

I HAVE frequently been applied to by foresters and others to give some description of the readiest and surest method of ascertaining the quantity of bark, &c. and consequently, the value of a coppice wood before it was cut down. I lie under many a promise to perform this task ; and I confess it was much

more difficult than I at first imagined. Were I desired to go to a growing wood of any description, of the extent of from one to ten thousand acres, and to give its value, I would find no difficulty in giving the value of wood and bark, &c. and that too within five per cent. either way. But to say that I, or any man, could lay down a rule for doing this work, without the person being a little in the practice of it, is altogether impossible. Were it measurable timber, as will be afterwards shown, it would be more easy ; but in taking young natural wood, where there are perhaps a thousand stools on each acre, and these averaging five or six stems, or shoots, from every stool, and not one of them measurable timber, (even this, however, were in some degree tolerably easy, if you have the number of acres, and can ascertain the number of stools and stems on each acre,) the result must, in a great measure, be ascertained by partly guessing at the average quantity of bark, &c. each stool will produce. But when

the ground is not measured, it must be worse. And though the whole wood ground were measured, if a person has not each acre by itself, in order to ascertain the number of stools on each, and the average number of stems from each stool, it is impossible to proceed in this work with any accuracy. And it is still more difficult when one has no knowledge of the measurement of the ground; supposing a person had, as it is always the crop on the ground that must be taken, where the crop is exceedingly various, and the ground in parts almost inaccessible, it is almost impossible in this case, without having had a little experience in the line, for any person, however plain it may be laid down before him on paper, to pretend to ascertain the value with any degree of accuracy.

Besides, the situation and soil will affect the weight of the bark very considerably. The quality of the timber, the thriving or healthiness of the growth of the woods at the

time of valuing, will also make the weight of the bark vary. If a coppice or natural oak wood has a northerly or a north-east exposure, the timber will be in general more durable and hardy, but the bark not so thick as when the woods have a southern exposure. In low dens, where the wood is well sheltered from all quarters, and where the growth must be more rapid, the bark will be thicker, and weigh heavier than in either of the former situations, but the timber will be more spongy. The poorest and most rocky soils produce the best or hardest timber, but not so thick or strong bark as better soils would do. As to quality, all foresters agree in this respect, that wherever oak timber, young or old trees, is well hearted, that is to say, much red wood in it, this is the best of the oak timber; but the bark on trees of this kind is not so good and thick as when the timber has more white or sap wood in it. Also, if the wood is very healthy and thriving, the bark will be better and easier peeled, than when

the wood becomes stunted in the growth, and has a great many dead branches on it. In the latter case, the bark too will be a great deal worse to separate from it, and will require a great deal more beating to raise or take off the bark; and in this case the bark is more dry, and will not weigh so heavy as when the wood is in a thriving state.

In valuing a wood that a person is an entire stranger to, he must consider all these things, and make his calculations accordingly; and having pierced the bark on several of the trees in different places of the wood, and ascertained its thickness, having some experience of what he is going to be about, I would, in order to assist him in the valuation, submit to his consideration the following observations and method:—

Suppose an acre of coppice oak wood, at 15 years of age, to contain, at 8 feet distance from each other, 855 stools, which an acre of ordinary good ground is very capable of bearing, and these stools averaging 5 stems from each, which is 4275 stems on an acre, these stems, at the above age, will, at the least, aver-

age 2lbs. of bark each stem, which is 3tons 16cwt. 1 qr. 10lbs.	
at L. 14 per ton, ...	L.53 8 9
Which is 15s. 4d. less than the average price for these last three years. (<i>See Sect. XXV.</i>)	
16 tons of brush timber in the acre as above, at 10s. per ton, ...	8 0 0
	L.61 8 9
Deduct expense of peeling the bark, supposing the women employed at 1s. and the men at 2s. 6d. per day each, is L.2, 15s. per ton, for 3tons, 16cwt. 1 qr. 10lbs.	L.10 9 11
Deduct carriage to the tan-yard, at L.1 per ton, ...	3 16 4
	L. 14 6 3
Value of one acre of coppice at 15 years of age,	L.47 2 6
Supposing the coppice 20 years of age, and each acre containing 855 stools, averaging 5 stems from every stool, is 4275. Aver- age quantity of bark on each stem is 3lbs. which is 5tons, 14cwt. 2qrs. 1lb. which, at L.14 per ton, is	L.80 3 1½
10 tons of brush wood, at 10s. per do.	5 0 0
1600 spokes, at L.2 per 100, ...	32 0 0
	L.117 3 1½
Deduct expense of blocking spokes, at 4s. 6d. per 100, ...	L.3 10 0
Do. expense of peeling, at L.2, 15s. per ton, ...	15 14 10
Do. carriage at L.1 per ton, ...	5 14 6
	L.24 19 4
Value at 20 years, ...	L.92 3 9½

Supposing the coppice 25 years of age, and 855 stools on an acre,
averaging 4 stems on every stool, is 3420; and averaging

5 $\frac{1}{4}$ lbs. of bark on each stem, 8 tons 1 qr. 7 lbs. at L.14 per ton,	L.112	4	1 $\frac{1}{2}$
Eleven tons of brushwood at 10s. per do.	5	10	0
2500 spokes, at 2s. per 100,	50	0	0
	L.167	14	1 $\frac{1}{2}$
Deduct expense of peeling at L.2, 15s. L.22 0 10 $\frac{1}{2}$			
Ditto for blocking spokes, at 4s 6d. per 100,	5	12	6
Ditto for carriage, at L.1 per ton,	8	0	9
	35	14	1 $\frac{1}{2}$
Value at 25 years,	L.132	0	0
Supposing the coppice 30 years of age, and 855 stools in an acre, averaging 4 stems from every stool, is 3420 stems, averaging 8 lbs. of bark on each stem, is 12 tons 4 cwt. 1 qr. 4 lbs. at L.14 per ton,	L.171	0	0
Six tons of brushwood, at 10s. per do.	3	0	0
3800 spokes, at L.2 per 100,	76	0	0
710 feet of measurable timber, at 2s. 6d. per foot,	88	15	0
	L.338	15	0
Deduct expense of peeling, at L.2, 15s. per ton,	L.33	11	9
Ditto for blocking 3800 spokes, at 4s. 6d. per hundred,	8	11	0
Carriage of bark to the tan-yard, at L.1 per ton,	12	4	3
	54	7	0
Value at 30 years of age,	L.284	8	0

The preceding statement is what an acre of ordinary good wood land, laid out for oak coppice, is very capable of producing, when

it is properly trained up ; and those persons who are acquainted with cutting and managing natural oak wood, will at once see that I am rather below than above the truth with my estimate. The nearness or distance of the situation of the wood to or from the market for the bark, will either lessen or increase the carriage, as will also the alteration in wages make either the expense of manufacturing less or more ; but for all these things allowances must be made.

I have made no allowance for the cartage of the spokes, because there is scarcely any part in the country but there is a wright that requires that article ; and he generally gives that price for them in the wood. But if the quantity should be too great for that particular part of the country, it is easy to make allowance for the carriage. I have allowed 6d. on the foot of the measurable timber to carry it to a sea-port, &c.

The surest method of estimating the crop as it stands on the ground, without regard

to the acres of measurement of the land, is to count the stools into twenties, and to take the average number of stems or shoots on every twenty stools ; then take the average quantity of bark on every stem, the average quantity of spokes every stool will produce, the average quantity of measurable timber in every stool, and the average quantity of brushwood on every stool. Having set down all these carefully and accurately in a memorandum-book, go through the whole wood in the same way, and add the whole together. Take the bark by the ton, say at the nearest place you expect to sell it ; the spokes by the hundred, at where you expect to deliver them ; the measurable timber by the foot, at the port at which you expect to sell it ; and the brushwood by the ton ;—add these together ; then make an allowance for the carriage of your bark, spokes, measurable timber, and the expense of cutting and peeling the bark, also the blocking of the spokes ;—add these together, and deduct the amount from the former

sum, and the remainder will be the value of the wood. The readiest method of counting the stools is, to cause two men to take a line, say about a hundred feet long or more, and passing the line round as many of those stools as it will inclose, the one man standing still while the other moves round a new number of stools, and count always the stools betwixt the two lines, causing the one man to move the one time with the line, whilst the other man stands still, and so on alternately ; the valuator at the same time taking care to average every twenty stools as they go on, before losing sight of the counted stools. This way too is a very speedy and sure method of counting the number of trees in any plantation. Or the stools of a coppice wood may be counted and averaged by two men going parallel to each other, and the person valuing going betwixt them ; the two men putting up marks with moss, or pieces of white paper on a branch of the stools ; the one man going always back by the last laid marks, and the valuator always counting and aver-

aging the stools betwixt the newly laid and the late laid marks, counting and averaging the stools, always as the men go on, taking only 20, or even 10 stools, at a time. To those who have been in the practice of doing this frequently, it will be found very easy, and will be done very speedily, and with a very considerable degree of accuracy. The proper method of learning to do this correctly is, when a person cuts an oak wood for the first time, (or even were the work repeated several times,) he should, in order to make himself perfectly acquainted with ascertaining the average quantity of bark that a stool, or even a stem or shoot from a stool will produce, go before the peelers, and select a stool or shoot, and after having examined it narrowly, he supposes it to produce a certain quantity of bark, and marks this down in his memorandum-book. He then causes a person to peel it by itself, dry it, and carefully tie it up and weigh it, and compare it with the weight he supposed it to produce, and he will at once see how near his calcula-

tion came to the truth. By frequently repeating this, he will soon be enabled to come near the truth, without making such a trial, and even without being at so much trouble as to dry the bark itself. I have often weighed it after being peeled, and allowed one-third part of the weight for the sap, which in bark from 15 to 30 years old will be found to be very near the true weight of it after it is dry ; but if the bark is much older, or if it be the bark of large trees, it will take considerably more than one-third part of the green bark to make the weight hold out when dried. I have also tried it, by measuring the stems of a stool, and reducing them to solid feet and inches ; and I have found this to be a very satisfactory way of finding the quantity of bark.

For example, a stem of oak from a natural stool—suppose it to measure in girth 2 inches by 7 feet long, will contain 2 solid inches and one-third of an inch, according to the measurement of Hoppus. This stem or shoot

will produce 2lbs. 2oz. of bark. Again, a stem or shoot of natural oak, measuring 4 inches in girth, by 9 feet in length, will be found to contain 1 solid foot of wood, and will produce $13\frac{1}{2}$ lbs. of bark. I have seen many shoots of this size, when all the branches were healthy and thriving, produce 17lbs. 8oz. Let it be observed here, that natural shoots of oak will produce more bark according to their measurement than young oak trees reared from the plant will do, as the trees from the plant require more pruning than those from the natural stool; for the rougher the coppice is, or the more branches are kept on, the more bark it will produce. See Section IX. of this work, also the plate of coppice trees. If it is intended to cut the coppice very young, little or no pruning is necessary.

If the forester will take the trouble to try all these different methods, as I have done in most of the counties in Scotland, he will find them to come very near the truth.

As to the plan of ascertaining it by solid feet or inches in very small stems or trees, the bark will vary a little, according to the quantity of branches peeled below what was measured.

I am aware, that here I run the risk of not falling in with the opinions of some of my readers, and even that from many of those who pretend to be good judges of the value of oak coppice wood. Such will insist that it is impossible for an acre of coppice oak wood, at fifteen years of age, to produce L.47, 2s. 6d. ; or that an acre, at twenty years of age, will produce L.92, 1s. 9½d. ; but particularly, that an acre, at twenty-five years of age, will produce L.132, 12s. 6d. ; and beyond all credibility, that an acre, at thirty years of age, will produce L.284, 8s. In answer to this, however, I might point out the place where such results were obtained, and produce evidence of the facts ; nor were these made on the best natural wood I have seen. But if the reader who doubts will consider the following, and make trial of it in ordi-

nary good coppice wood, he will at once acknowledge that I am rather under than above the real calculation. It surely need not stagger the belief of any person who is in the smallest degree acquainted with rearing of natural oak woods, to see a natural oak stool at fifteen years of age, bearing five stems each, which will make two paling stobs, and of course will measure fully more than two solid inches, and one-third of an inch. Nor is it at all uncommon to see thousands of natural stools of oak at thirty years old, producing four stems, each of which will average one solid foot; and of course will produce upwards of three stones of bark, which will be seen to be far above the calculation, either at fifteen or thirty years old; but if I were to select the best growths I have seen at the different ages mentioned, I should go far above either of these calculations. But I have been careful in the foregoing, to select only those acres, by carefully attending to the cutting and rearing up of which, in the

manner herein laid down, the poorest soil of natural wood land (marshes excepted) in Scotland, is capable of producing.

Were I to give instances of the growths of natural oak stools I have seen on good soils, I should not exceed the bounds of truth, although I were to double the proceeds herein stated.—For the sake of those not acquainted with rearing wood, allow me to give the four following examples, taken from actual measurement.

A TABLE, showing the Growth of several Natural Stools and Seedlings of Oak, taken from actual Measurement.

PLACES WHERE THE DIFFERENT MEASUREMENTS WERE TAKEN.	Ages of the Growth.	First Stool.	Second Stool.	Third Stool.	Number of Stems in all.	Average measure of each stem.		Measurement of the whole put together.	
						Feet.	Inches.	Feet.	Inches.
On the estate of Ormiston Hall, in East Lothian, taken in 1804.	30	5 stems.	4 stems.	3 stems.	12	5	6	66	0
In Glen Shirra, near Inverary, Argyleshire, taken in 1810.	25	6 stems.	5 stems.	4 stems.	15	3	6	52	6
Three stools of Ash, on the estate of Boguham, in Stirlingshire, taken in 1812.	20	6 stems.	5 stems.	4 stems.	15	3	4	50	0
Bankend wood, estate of Touchadam, Stirlingshire, which I cut in 1804; measurements taken in 1820.	16	8 stems.	6 stems.	4 stems.	18	0	4	6	0

Seedlings measured in the said coppice, which, when the wood was cut, must have been at least three inches in circumference, three feet from the ground, and from four to six feet high. These were the largest sizes left in Bankend wood, when cut. At Ormiston Hall, in 1804, twelve of the best seedlings put together in said wood only measured forty feet nine inches ; in Glen Shirra, in 1810, fifteen of the best of the seedlings in said wood, put together, only thirty-three feet seven inches. In the wood of Bankend, which wood was growing in 1820, eighteen of the best seedlings only measured four feet five inches.—The bark is included in the foregoing measurements.

By this statement it will be seen, that natural shoots of oak make far more rapid growth than seedlings, or from the plant ; nor are they nearly so liable to misgive in rearing.

I grant that the foregoing measurements were taken from very thriving stools, and

which stools grew on a good soil ; but it would be very possible (and no one who is acquainted with the subject will doubt it) to have 600 stools on an acre of good land, which would place each at ten feet distance from each other every way, and these, at the age of thirty years, to average four stems from each stool. But granting they only were to average three solid feet from each stem, which is less than those at twenty-five years of age, there would be 2400 stems on an acre, average three feet each, which is 7200 feet, which, at 2s. 6d. per foot, (a low price, including bark) is no less than L.900 Sterling per acre at thirty years old. Who would not think oak woods worthy their attention in rearing, after considering what it is possible to gain by them ? I have seen, since the above was written, one acre of coppice wood, at twenty-four years old, produce of wood and bark L.290 Sterling, and the bark only sold at L.11, 11s. per ton.

Since writing the above, I have been favoured, by J. Francis Erskine of Mar, Esq. with the date of planting some large oak trees, which I cut on his estate of Alloa in 1817. They were planted in 1706 and 1707. Many of them measured upwards of 140 solid feet; one in particular, which grew between a lime and a poplar, not more than eight feet distant from each other, measured sixty-two feet nine inches in length, of a straight bole, and the girth on the side of the square $13\frac{3}{4}$ inches. A poplar, planted at the same time, and cut in 1817, measured 235 solid feet. Many oak trees planted at the same time, still stand on the same ground, and will measure 150 feet.

SECTION XXVIII.

OF MAKING ALLOWANCES FOR THE BARK WHEN MEASURING AND VALUING GROWING TREES.

WHEN trees are old, with their bark on, it is common to make an allowance to the purchaser for the thickness of the bark; and the allowance to be made is supposed to reduce the tree to what it would be if the bark was stripped off. Various disputes have arisen of late years betwixt sellers and buyers as to the allowances for bark; and scarcely two measurers will, in measuring a quantity of round rough timber with the bark on it, come within 5 or 6 feet in 100 of each other. Hence it is become very common in many places for the buyer, when he makes the purchase, to make a clause in the agreement for the bark

The above deductions will be found to answer in almost all trees, the same as if the bark were stripped off, unless in very old rough corky-barked trees, or when there is much moss growing on the bark. When the girth is taken in this case, it may require a little more allowance ; but of this the practised measurer will easily judge. And let it be here observed, that when trees are measured lying in the wood where they were cut, and if sold to be carted or shipped to any distance, the allowance should be made more fully, in order to make it stand out, than if the tree were lying where it was to be used ; as by carting, &c. a little of the roughness is rubbed off the bark ; and in many cases, when only one-eighth part of an inch of the extreme girth is lost, it takes one-fourth part of an inch of the side or square, when the girth is taken with a line.

For example, when the girth is taken with a line round the tree, the line is doubled, and applied to the foot rule ; and the half of

what the double line measures on the rule, is taken for the side of the square, which is one-fourth of the whole girth. And when the line is doubled, and applied to the foot rule, unless the line comes to an inch or half an inch, should it only want one-sixteenth part of an inch of the double line, it is not counted, but thrown away: nothing but fourths of an inch being taken in this case, nearly three-eighths of an inch are thrown away of the double line, which is about three quarters of an inch often lost on the whole girth of line measure.—See this explained more particularly in measuring with the newly invented machine for measuring growing trees.

SECTION XXIX.

OF VALUING FULL GROWN OR MEASURABLE TREES.

THE value of all kinds of trees, excepting those whose bark is used, and is of value as well as the timber, is easily ascertained by their measurement, which is taken in solid feet and inches, according to Hoppus, the standard measurer through Britain for all kinds of timber. Having taken the length and girth of a tree, or trees,—the way and manner of which is described in explaining the measuring machine,—and having brought the tree to solid feet and inches, and having also fixed on the price per solid foot, that such a tree, or number of trees, is worth, you will at once ascertain their value. But it requires a very different manner of calcula-

tion to ascertain the worth of those trees whose bark is of value.

Let us first begin with the oak tree, the bark of which is the most valuable. And here it may be proper to observe, that a great difference of opinion, as to the method of ascertaining the value of an oak tree, with its bark, exists, as every valuator has his own peculiar way of doing it. Hoppus, that excellent timber measurer, says that the value of the bark of each oak tree, generally holds to be about a third part of the value of the body and head. But it appears from this, that Mr. Hoppus had not been a practical measurer and valuator of oak trees with their bark; for this will not hold good in one tree out of a thousand.

For example, if we take hedge-row trees, or trees in very exposed situations, that are what is generally termed scraggy trees, such as have short trunks or bodies, and large spreading tops, without any measurable branches on them,—trees of this description

will be found to have more value of bark, according to their solid measure, than a tree whose body or trunk runs up towards the very top of the tree, and has few or no branches on its top.

Suppose you have an oak tree on the outskirts of a plantation or a hedge-row, whose top has had abundance of room to spread. If its body or trunk measures nine feet long by nine inches, the fourth of the girth or side of the square, the trunk will measure five solid feet ; and it having a very large top, but no measurable branches on it such as will stand six inches square,—which has been already observed is only reckoned measurable timber,—such a tree will contain ten stones of bark, which, at 2s. 3d. per stone, is L.1, 2s. 6d. for bark ; and, reckoning the timber at 3s. per foot, it is only 15s. for timber. Here the bark of this tree is worth 7s. 6d. more than the measurable timber ; and many such trees as this are to be met with.

But let us take another example. We have an oak tree, which measures twenty feet long in the body, and twelve inches on the side of the square; which makes twenty solid feet. And, suppose there are as many branches on its top above six inches as measure ten solid feet, making in all thirty solid feet, then very few branches on this tree being fit for barking or being peeled, it will be found only to produce $22\frac{1}{2}$ stones of bark; which, at 2s. 3d. is L.2, 10s. $7\frac{1}{2}$ d. Now, 30 feet of timber, at 3s. per foot, is L.4, 10s. Here the timber of the tree is L.1, 19s. $4\frac{1}{2}$ d. more in value than the bark. But, adding the value of the wood and the bark together, we find it L.7, 0s. $7\frac{1}{2}$ d. which makes the above tree to be worth, on an average, wood and bark included, 4s. $8\frac{1}{4}$ d. per solid foot. Now, let us add the wood and bark of the first tree together, which make it L.1, 17s. 6d. which, including wood and bark, on an average, is 7s. 6d. per solid foot.

A great many, in valuing measurable oak trees, go on the following data, that every

oak tree will produce one stone of bark for every solid foot of timber ; and a great many insist upon this holding good in every case ; but the two examples, which are taken from actual measurement and weight, amongst many more that might be given, show the absurdity of this way of calculating, in which both the seller and buyer have been in many cases deceived—and more particularly, if the trees are sold by the foot while growing.

To give one striking example of this :—In the year 1806, I was called to superintend the cutting of 250 oaks, (all hedge-row trees,) which were purchased on an estate in Clackmannanshire, at 3s. per foot, bark included. When the trees were cut down, a sworn timber measurer, from the port of Alloa, was called to measure them, which he did accordingly, and made about 1000 feet in the whole. None of the timber of those trees being measured under 6 inches, of which a very great part consisted, and all of them having large tops, I weighed, from of the above 250 trees,

(measuring 1000 solid feet) 1865 stones of good dry bark, ready for and delivered to the tanner, which was very nearly two stones of bark for each foot of measurable timber.

Here it may be proper to observe, that some oak trees, though not so valuable for their timber, may be better worth 7s. 6d. per foot than others that have more valuable timber may be worth 4s. 6d. per foot.

From what has been already said, it will be easily seen, that, as trees are so various in the sizes of their tops, which is the great means of their producing less or more bark, according to their measurement, it is impossible to lay down a perfect rule for ascertaining it, without examining minutely the tree itself. A practised measurer, when he sees the tree, must judge of it accordingly ; every tree, therefore, the bark of which is of value, particularly the oak, must be valued by itself.

After taking the measurement of the timber in solid feet and inches, set it down at

what the timber of such a tree is worth per foot ; then calculate on the quantity of bark, in stones and lbs. that such a tree, according to the quantity of small timber that is not measured on it, will produce of bark, and set down the price per stone that it will sell at ; then add the two together, and you will obtain the gross value of the tree. This is certainly the surest way of valuing large trees. The method of measuring small trees is explained in Section XXVII.

In valuing coppice trees, let it be carefully observed that the bark of trees, as already explained, will vary considerably in weight, according not only to the size of the tree, but also to the coarseness or fineness of the quality of the bark.—The following observations, taken from actual measurement and weight, may assist a young beginner, in ascertaining the quantity of bark from various trees. An oak tree, about forty years old, measured down to $4\frac{1}{2}$ inches side of the square, and weighing only the bark peeled

off the timber that is measured, without including any of the bark of the crops, &c. every foot of measured timber will produce from nine to eleven lbs. of bark. An oak tree, of eighty years old, weighing only the bark peeled off the measurable timber as above, every foot will produce from 10 lb. to 13 lb. of bark. Every foot of large birch timber peeled as above, will produce 14 lbs. of bark. Every foot of rowan tree as above, will produce $11\frac{1}{2}$ lbs. of bark. Every foot of the willow, unless a very old tree, will produce from 9 to 11 lbs. of bark. Every foot of larch fir, not exceeding thirty years old, will produce from 7 to 9 lbs. of bark.

The timber of trees, particularly the oak, is peeled out, every crop or branch, down as small as an inch in circumference; and, as was said before, according to the quantity of branches, or measurable wood on a tree, so will be the quantity of bark.

SECTION XXX.

OF CUTTING DOWN LARGE TREES.

WHEN trees are to be thinned out of a plantation, and when the remaining trees are to be nursed up to maturity, or even when large trees are cut out from among young coppice wood, the greatest care ought to be taken not to hurt the trees remaining. For this purpose, the trees to be cut ought to be lightened in the top as much as possible, by cutting off a number of the top branches, and particularly those that hang most over the trees which are to stand. This is done by a person going up the tree with a ladder, and, with a hand-saw, cutting off the impending branches. But this is both a tedious and very dangerous operation, and might be more

safely and speedily done by fixing a hand-saw to the end of the connecting rods for working the measuring machine: by having a hand the same as that of a saw on the end of one of the rods, and by giving the saw a little extra setting, a person may stand on the ground and cut off a branch of any size or height from a tree with ease and safety. A few rods (a little stronger than those used for the measuring machine, with the connecting screws a little larger, say about $1\frac{1}{4}$ inch diameter, with a thin plate of iron on the end of one of the rods, to screw it to the hand saw,) kept for this purpose would be of great use in pruning trees, and would be attended with many advantages. In cutting large trees, that stand nearly perpendicular, in order to make the tree fall the way required, enter the cross-cut saw on that side of the tree it is intended to fall, and cut it about a third part through; then enter the saw at the other side, and when it is cut so far as to admit a wedge, place the wedge ex-

actly opposite the way you want the tree to fall, and keep driving it slowly till the tree is nearly cut through. Be sure the saw meets the opposite cut equally on both sides ; and do not imagine, as some have done, that, by making the saw meet sooner through the one side than the other, the tree will fall to the side soonest met or first cut through : on the contrary, the side of the tree longest in being cut is that side to which the tree will naturally fall.

By attending to the above hints, it will be found very easy to make a tree fall any way ; but if the tree has a heavy top, or if it inclines very much to that side on which it is not intended to fall, it will be necessary to make use of a rope. For this purpose, the connecting rods will be found very advantageous, by having a hook at the end of one of them, so that the rods may carry up the rope, and fix it on the top of the tree, without the very dangerous and laborious work of a person going up the tree to fix it.

SECTION XXXI.

OF BARKING OAK WOOD, AND PREPARING THE BARK
FOR THE TANNER.

THE time to commence the barking or the peeling of all kinds of wood has already been pointed out in Section IX. of this work. All that I intend here, is to describe the manner of peeling, and otherwise manufacturing the bark. With this view we shall suppose that the forester is about to commence the operation of barking, and that he has engaged a proper number of the best instructed men and women that can be had for barkers, according to the extent of his undertaking. The barkers are each furnished with light short handled mallets, made of hard wood, about eight or nine inches long, three

inches square at the face, and the other end sharpened like a wedge, in order the more easily to make an incision in the bark, which is done all along the side of the tree which happens to be uppermost in a straight line; and as two barkers are generally employed at one tree, or large piece of timber, it is proper that whilst the one is employed in making an incision with the mallet as above, the other be furnished with a sharp instrument, called a bill, or *whittle*, resembling a hedge bill, with which the bark ought to be cut across the tree, in lengths of from 2 feet 6 inches to 3 feet. Having thus made the incision in the bark both ways, the barkers being also each furnished with what is called peeling irons, an instrument made of iron about six inches long, $1\frac{1}{4}$ inch broad in the face, sharpened like a wright's chissel, a little bent in the broad way, the more effectually to go round the tree, having a handle of wood about 4 inches long; if the tree, or piece of timber to be barked, is such that the two

barkers can easily lift one end of it, this is placed on two pieces of wood, 3 feet long, and called horses, these are about the thickness of a paling stob, and have a forked end on each about 6 inches long, the other end sharpened to go into the ground. Two of these horses are placed in a triangular form against each other, one end of the piece to be peeled being raised on the horses, the two barkers standing opposite to each other, and entering the peeling iron into the incision made by the mallet, and pressing the iron downwards between the bark and the timber. In this way it will be found very easy to take the bark off in one whole piece round the tree, and, if possible, take the bark off in one whole piece, as long as the incisions made in the bark. In some cases where there is not much sap, the bark may require a little beating with the square end of the mallet, to cause it to separate easily from the wood ; but the less beating with the mallet the better, as it has a tendency to blacken the bark

in the inside, or fleshy part of it, so that when the tanner sees it he supposes it to be damaged, and undervalues it. The branches of the tree being previously all lopped off with the axe, the persons, in number according to the extent of the work, with a bill or whittle smooth all the branches, cutting them in lengths of from two feet six inches to three feet, down as small as one inch in circumference. The barkers, principally women, are each provided with a smooth whinstone about six or eight pounds weight, beside which they sit down, and, having collected a quantity of saplings, branches, or twigs, they hold it on the stone with the one hand, and, with the mallet in the other, they beat the piece till the bark be split from the wood from the one end to the other, and taking it off all the length of the piece if possible, then lay it regularly aside till a bundle of considerable size is formed.

The point most particularly to be observed in this art is, putting the bark up to dry ; which is done by putting the bark upon what

is called the lofts or ranges. These are erected by taking forked pieces of the loppings, called horses, the one three feet long, the other two feet six inches, and driving each about four inches into the ground, opposite one another, about two feet asunder in the breadth, and as much betwixt them, lengthwise, as will admit long small pieces of wood to be put upon them, and as many of these must be put together as will hold the bark of every day's peeling. These ought to be erected in as dry and elevated a spot as can be found in the wood. The bark being carried and laid on this loft, with the thick ends of it all laid to the high side of the range, and the small bark laid on to the thickness of about six inches ; and the bark taken off the largest of the wood laid regularly on the top, which serves for a covering, and the lofts or ranges having a declivity of about six inches, the rain will run off them readily, and if properly put up in this manner, they will keep out a great deal of rain. After it

has lain in this state for three days, if the weather is good and dry, it ought to be all turned over, and the small bark spread out, so as not to allow it to stick together, which, if much pressed, it is apt to do ; and if it does so with the natural sap in it, it has a chance of moulding, which is extremely hurtful to the bark, and both lessens it in weight and in value. After the bark has stood on the ranges about eight or ten days, if the weather be good, it may either be put into a house or a shed ; or if intended to be put up into a stack, it may now be done. A stack of bark ought never to exceed eight feet in width, and twelve or fifteen feet in height, raised in the middle like a hay stack ; and if it is intended to stand any time, it ought to be carried beyond the newly cut wood, or hag, and put up in as airy a place as possible ; and on no account whatever ought the bark to be stacked above any of the newly cut oak stools. If it is to stand any length of time in the stack, it ought to

be thatched either with straw, bog-reed, long heath, or broom ; and if in good order when put into the stack, it may remain in it, if necessary, all winter ; but if it be so intended, it must be removed beyond the newly cut hag altogether. The greatest care ought to be taken to preserve the colour of the inner parts of the bark, because the colour of it is generally looked to as a principal criterion of its value ; and the merchant or tanner judges of its value chiefly by its colour. Before being put into the stack, the natural sap ought to be dried out of it, in order to prevent its fermenting ; because, if a fermentation takes place in one part of the stack, it generally goes through and spoils the whole.

The same mode of treatment will do for all kinds of bark as well as the oak ; but the birch, the larch, and the willow, will peel in April.

In barking the birch, there is an outer or shreddy skin upon it, which is of no use and

rejected by the tanner, and must be peeled off. This used to be done at such an expense as almost over-balanced the price of the bark. Within these twelve months I have found out a method of doing it most effectually and cheaply ; which is this : In spring, say early in March, make a longitudinal incision in the bark, to the deepness of the wood of the tree, or trees, to be cut and barked in the following summer. This being done, when the sap ascends the tree it will throw off the shreddy skin, so as it can be taken hold of with the hand, and pulled off in one piece round the tree. If the trees are very large, it will be necessary to make an incision on two sides of the tree, in opposite directions. The incision can be easily made by fixing the cutter of a wood marking iron to the end of a small rod ; the connecting rods for the measuring machine will be found very useful for this purpose. When the bark is ready for the tanner, it has to undergo the work of chopping, which is done

by driving in two or more stobs into the ground, with a fork on the upper end of each, leaving them about two feet six inches from the ground, and laying a long round piece of wood across between the two, where a number of people stand, and the bark is carried and laid down behind them, which they take up in their hands, and lay on the cross tree; and then, with a sharp whittle or bill in the other hand, they cut it into small pieces, about three inches in length: when this is done, it is trampled into bags which hold about two cwts. each, and in these bags it is weighed when sold by the ton, in tons, cwts. quarters, and pounds, English weight; and when sold by the stone it is generally weighed with Dutch weight, and in the above manner delivered to the merchant or tanner. Formerly it was a custom to sell bark by the boll; and in some places of the Highlands it is still practised, and sold at ten Dutch stones per boll.

SECTION XXXII.

TRANSPLANTING LARGE OLD TREES.

THERE may oftentimes be occasion for removing trees of a large size and growth, either to ornament a newly made place, or to supply the place of some large favourite tree, that by stress of weather, or some unforeseen accident, has been destroyed, or that may have fallen a prey to the ravages of time. To supply the place of such a tree with somewhat of a corresponding object to the one now gone, is of the greatest importance. Allow me here to observe, that although a tree of any weight and size may be removed and transplanted by the machinery, as shown in the plates and figures for that purpose, yet this can only be done with safety for their

future prosperity with a healthy, thriving, growing tree, and not yet arrived at its full growth. If this is carefully attended to, by the following method there is no doubt of success. Here, however, the greatest caution is necessary to be used, to prevent the loss of the tree, which naturally would and does often happen when such transplantations are set about rashly, and without the necessary care. When there is occasion then to remove a very large tree, the method to be taken is this : A year at least, and if allowed two, so much the better, before the tree is removed, let the earth be opened at from three to four feet from the trunk of the tree, (that is to say, not to touch the roots nearer the tree,) in form of a trench ; dig this pretty deep under the horizontal roots, so as to leave a ball of earth about the stump of from six to eight feet (less or more, when the trees are very small or very large,) in diameter. When this trench is dug to the needful depth all round, and the side roots at

that depth are all cut through, if it be found that the tree has a perpendicular root, as many trees have, it will be necessary to apply a rope to the top, or nearly so, of the tree, and place the portable machine, (see the plate,) which we may call a winch or crane, at a proper distance, and put the rope round the roller; and two men turning the wheel, one at each side of the winch, will easily bring over the tree, so that a person with an axe may cut through the perpendicular downright, or what is called the top root, and having done so, allow the tree to return back to its former situation. Having done this, let the earth that was dug out of the trench be thrown in again. If the tree is in an exposed situation, and supposed to be in danger of being blown down with the wind, it will be necessary to fix two more ropes to its top, and drive in three stakes at some distance in the ground in three opposite directions; and drawing the ropes tightly, which may easily be done with a few turns of the winch,

and fastening these ropes to the stakes, the tree will be able to resist with safety the most furious winds. In this manner the tree must be allowed to stand one year, and if two so much the better, the more sure will be its growth when removed; and, if time would permit, it would be much the better for standing three seasons in the above prepared state before being removed. But a good deal as to this depends upon the tree itself. If a young healthy tree, say from twenty to thirty years of age, one season will do, but if an older and large tree it will require more. Observe that this operation must be performed very early in spring, on or before the 1st of April; and the trees should be removed, and put into the place where they are to stand, on or before the 1st of March. But I would much rather advise them to be removed in the end of November or in December, immediately after they have thrown off their foliage; as, if it is an open winter, the roots will begin to strike

very early, and this gives them every opportunity of vegetation. It may be said, the winter gales will be against them ; but I would here advise that the same method in fixing them, where they are to remain, be taken as in taking them out, say by three ropes from the top, which may remain for three or four years, as need may require, according to the size of the tree. This will be found a much more safe and effectual method than fixing them by poles to the trunk of the tree, as these generally hurt the bark of the tree ; nor do they properly keep the tree from shaking with the wind, which retards its growth when the tree is set up into its place. When planted, it should be placed upon a quantity of fine mould, and a large quantity of the same, mixed with a little cow-dung, for filling up the holes upon the top and at the extremity of the roots, beaten up with a sufficient quantity of water, to reduce it to a kind of paste. A small sprinkling of lime may be added, which will keep away vermin from

destroying the young tender fibres of the roots. When this is done, and the holes properly filled up, cover over the whole with turf, and lay a quantity of stones about the bottom of the trunk, which will keep the ground moist, and help to preserve the tree steady. Be careful also to place the tree in the same direction to the sun as it stood when it was reared, that is to say, place the same side of the tree towards the south that stood southwards when it was reared. This can be easily done, by placing the removing machine or carriage in the very same direction that it was placed in to receive the tree, as the tree is taken down with and upon the machine, and carried to its place, and put up with it before being disengaged from the carriage. For a more full account of the transplanting of large grown trees, see the explanation of the plates.

SECTION XXXIII.

OF THE DISEASES OF TREES.

As in the animate creation, so it is in the inanimate, which may also be said to possess life, and is subject to diseases. Still confining myself to the forest, it is only the diseases to which forest trees are subject that I shall for the present take notice of.

When the top of a tree begins to decay, it is to be suspected that there are faults in its body: when in any tree there is a swelling vein perceived rising above the level of the rest of the tree, and covered by the bark, it is a sure sign all is not well within; more particularly when this vein twists about in the manner of ivy, it is the worst sign of all, and seldom or never is seen but when the tree is otherwise

faulty. All such trees will be found more or less shaken in the heart, as it is generally termed, that is, the tree will be all in splinters. This is particularly the case with both Scotch and English elms. Nothing is more detrimental to the value of trees ; for timber, when splintery, is equally bad as when rotten in the heart, as it will cut up for no purpose whatever ; nor is a splintery tree fit to be used in one lump, particularly in any part of ship-building. A tree may often have blemishes in the outside, which is often the effect of injudicious pruning ; yet it may be sound in the heart, excepting where the branch has been lopped off, which always leaves a blemish if the branch has been of any size at the time ; and if the tree stands long after it has been taken off, and if the part where the branch was lopped off is not carefully covered up, it often rots the main trunk of the tree. If a tree shows symptoms of decay in the top, without any apparent cause, a very good method to ascertain from

what cause, is to open the earth about the roots, and carefully examine in what condition they appear. If they are fresh, sound, and full of juice, it is a sign all is well about the root ; and very likely all will be well also with the main trunk of the tree, and the symptoms of decay in the top must proceed from some other cause : but, on the contrary, when many of the roots are found in a decayed state, without any visible cause in the ground, or when some of the roots are rotten, brittle, and mouldy, there is something wrong with the root ; and the decay of the top proceeding from this cause, it may with good reason be suspected that all is not well with the main trunk of the tree. I believe very few have made a point of examining the roots of a tree to ascertain the causes of its decay, although in one case out of ten the cause will proceed from the root. Often when I proposed to examine the root, it was counted foolishness, and a chimera of my own ; but although this is said to be a new way to discover the

state of a decaying tree, and has not been attended to, I will aver, whether it be counted chimerical in me or not, that a decay here in the root is a more fatal sign of the total decay of the whole tree, than the deadness of any part of the head of it. Trees may be, and oftentimes are, blighted, or, what is more generally termed, frost-bitten ; or I would suppose it frequently the effects of lightning ; but in the most of these cases, when only affected in the top, it only stops the growth for one or two seasons, and they again recover, excepting when the trunk of the tree is struck by lightning, so as to splinter the timber and separate the bark from the tree, which often happens, and in such cases the tree is altogether destroyed. Severe dry frosts are often fatal to trees even of a large size, and oftentimes rend the trunks in a manner similar to thunder, and kill the tree.

A very particular instance of this happened some years ago to a large old ash tree

on the estate of Carstairs, the property of Henry Monteith, Esq. M.P. Mr. Loudon, the gardener, chanced to be passing the tree in the time of a severe frost, when he heard a crackling noise, the same as if a large piece of timber was rending in pieces by the force of axe and wedges. On stopping and turning to the tree from which he supposed the sound to arise, he perceived, on looking into the trunk of the tree, (which was between two and three feet in diameter,) a longitudinal incision or rent from the root to the top of the trunk, so as to admit of his hand going into the heart of the tree on one side. The tree was perfectly sound before, but will always bear the marks of it, although still thriving. Many more instances of a similar nature could be given of such effects of severe frosts on healthy growing trees. A great many of the blemishes formerly mentioned in the elms, &c. are the effects of frost. It may be worthy of observation here, that upon those trees

that are most vigorous in growth and full of sap, the frost is most severe, and particularly if the frost happens to be late in spring, after the juices begin to ascend and flow freely through the tree. At this time and season its effects are most severely felt after a fall of rain. The effects of frost are also felt on timber in the log. This is well known to the sawers of wood. Thus if the log is green, with the natural sap in it, or soaked with wet, in a severe frost the log is very brittle, and the saws will with difficulty cut it. Insects very frequently occasion a very serious disease in trees of all kinds, but particularly in the larch and common Scotch fir. These in prodigious numbers attack the larch fir at first on the extreme points of its branches, and soon overrun not only the whole tree, but often a whole plantation. They present a downy white colour like hoar frost. When squeezed in the hand they fill it with blood, and make the fingers stick together like glue, which may be occasioned by their emitting and liv-

ing on the rosin of the tree. Insects attack the Scotch fir, by piercing through the bark into the timber, which is discernible by the tree emitting the rosin sometimes in hundreds of places on the trunk of the tree, in form of white drops, like small beads. At each of these places there is a small hole, fit only to admit the point of a pin, in which is the insect. So soon as these spots are perceived in a fir tree, it never lives above one year after ; and as soon as the tree first attacked dies, they seize upon another healthy one, and so on till they have been known to kill a whole plantation. Moss, or what is commonly called fog, is very injurious to trees of all kinds, which is the effect of damp, from want of draining, thickness, or closeness of the trees upon the ground, and allowing a poisonous kind of grass to accumulate among the roots. Moss is also often occasioned by injudicious pruning, when the root of the branch is not properly dressed, but allowed to rot, from whence moss grows, and harbours

insects, which overrun the top of the tree and kill it when the root is clear. Canker is a disease incident to trees ; but this is most commonly occasioned by external injury done the branches by friction on each other, cattle biting off the bark, sheep rubbing on the trunk of the tree, or some of the causes already mentioned.

MEANS OF CURE OF THE DISEASES IN TREES.

Fault in the Roots.

This may be occasioned by a sudden transition from dry to wet, or from wet to dry : extremes in either case should be avoided. I have known a row of trees, chiefly oaks, almost killed, by opening a ditch within about eight feet of them to drain the ground. The first year after the ditch was cut the trees all died ; many of them scarcely put forth a green bud. The second year they were much worse, not a liv-

ing tree. The proprietor began to despair of their recovery, and wished them sold, although with reluctance, as they were, from the situation they occupied, very ornamental. I requested of him to let them stand for another year, I having in autumn, the second year after the ditch was cast, dug amongst the roots by the sides of the ditch. I observed new small fibres striking downwards in search of new ground. The third year some of them put forth a few scanty buds; the fourth year the whole of them put forth a few buds; and the fifth year all of them were again in full blossom. This plainly showed me that the roots of trees extend a great way under ground, and will push and find their way to good soil if there is any near them, as the roots of these trees are now crossing the ditch below, and rising up on the other side. When the disease of a tree is found to be in its roots, I have found it of the greatest service, and have often recovered dead trees, by carefully cleaning away all sour moss or fog

from the surface, and also paring away all the rotten roots, and adding some fresh earth with a sprinkling of lime. I have also, when the tree was totally dead, and the cause proceeding from the roots, recovered them, by throwing a few of the surface roots open, paring a little of the bark off the top of the roots with a very sharp adz, and allowing these to stand exposed to the sun for a season, say from April, when it should be done, till September, taking care not to interfere with the earth below the roots; and if there is the least sap in the roots, or if not totally decayed, they will send out new fibres by, and often before the month of September, when they should be covered with fresh earth, and the whole covered over with a white clover turf, not exceeding two years old—the turf not less than three inches thick, which will keep the roots warm and moist, and encourage vegetation. By this method I have often recovered dead trees when the disease proceeded from the roots.

Blight on Trees.

This, as I said before, is often the effects of lightning and frost, and takes effect most commonly after the blade is out, and kills the growth of the tree for a season. I have often recovered the year's growth, although it kept it late, by paring off the bud with a sharp knife, and cutting off the top shoot by the next eye in young trees or plants. But this would be far too laborious a task for the forest. Gardeners may take the hint for the orchard. Frosts, as I said before, are injurious to trees; and here I would particularly caution the forester not to prune any in time of frost. Although dry frost is a season favourable for working in the forest in winter, yet pruning of no kind should be done in frost, even admitting the branch to be pruned off should not be half an inch in diameter; but particularly so when the branch is of considerable size, as it affords an opportunity for the frost to penetrate into the

heart of the plant or tree, and is more or less injurious to the timber or growth of the tree. Here, by the way, it may be proper to notice the time most proper for pruning forest trees. All kinds of hard wood trees should be pruned in the months of March and April, after the most of the severe frosts may be supposed to be past : say the plane, lime, poplar, and all kinds of willows, early in March ; and the oak, Spanish chesnut, elm, beech, ash, hornbeam, and maple, before the end of April. Let it be here observed that the pruning I mean, at this time, is, when it is necessary, to take a branch off any of these larger than two inches in diameter at the bole of the tree ; and when such a pruning, or amputation of a large branch becomes necessary, it should always be done in the above months, and that too in a dry day ; and, before getting wet, the wound covered over with the balsam, as recommended in the cure of canker, &c.

Insects.

The insects, as before mentioned, that attack the larch fir in such vast numbers, are most frequently to be found in plantations that are allowed to remain very thick, and which is too frequently the case with larch fir plantations ; it being foolishly imagined, that larch fir trees will not come to perfection or maturity, unless allowed to remain at six or eight feet distance tree from tree. As I said in the section on thinning, the larch firs will do closer than almost any other tree ; still, as they grow to a very large size, they require a very considerable degree of room : and although these insects attack sometimes a single larch fir tree, the only remedy I have ever found for preventing them from overrunning a whole plantation, is to thin them out early to the distances they should stand to be reared up to maturity, as directed in thinning larch plantations, so as a free circulation of air may be admitted through

the plantation. When insects attack the black, or Scotch fir, in the manner as aforesaid, the only way to prevent their ravages, and save the tree, is to scrape off the outer bark wherever they are seen to make their appearance, and lay that part of the tree over with the balsam, which will completely prevent them from spreading over and killing the tree. This, however, would be both an expensive and laborious work for the forest, but may be easily done to save and preserve a favourite tree. But when a tree is attacked in the forest, and when it can at all be spared, to prevent its infecting other trees, it should be immediately cut down and taken out of the wood. Moss often harbours insects; and whenever it is seen to grow on, or begin to cover a tree, either about the root or amongst the branches, it should be scraped off; which is very easily done, by fixing a scraper to the end of a rod, which may be made to any length by the connecting rods, and the moss scraped off either the trunk of the tree or its

branches ; which could be done by women or boys at a very trifling expense, scarcely worth naming, when it is taken in time, and which will often save the life of a tree, at least greatly facilitate its growth.

Canker Wounds, and Bruises.

From whatever causes these may proceed, wherever the tree is barked, and the timber not injured, pare carefully off, all round the place wounded, the loose parts of bark close into the wood of the tree ; then paint the wounded place over with the balsam prepared as afterwards described, extending it about one inch over the adjacent parts of the bark. If a branch is broken off by the wind, or otherwise, when the timber of the tree is much injured, let the loose splinters and particles be properly dressed and cleaned out, even allowing it should go into the heart of the trunk ; always sloping it downwards, so as not to lodge water, and taking off all the loose bark as aforesaid, then laying it over with the balsam, taking care

that the place dressed up be properly dry when it is laid on. Or when it becomes necessary to take a large branch off a tree, let the place where it is taken off be properly dressed up, close into the trunk, as described in the section on pruning, &c. and then lay it over with the balsam. By attending to the above directions, this balsam will not only prevent the tree from dying, when much injured, but will have a tendency to draw the new bark very rapidly over the places injured.

By carefully attending to the dressing up of the wounds, as aforesaid, and timely applying the balsam, I have no hesitation to aver that the lives of many valuable trees may not only be preserved to maturity, but also their timber, when cut down, rendered much more valuable.

Preparation of the Balsam.

This balsam is prepared in the following manner:—Take of the liquid extracted

from the oak timber,* one gallon, one English pound of salt ; boil it till the salt is all dissolved ;† pour it upon new burnt lime-shell, till it falls into dust ; put the lime through a very small wire riddle ; mix it up with whale oil in the manner of paint, keeping it considerably thicker than common paint ; and to give it the colour of the bark of the tree, add a little lampblack, or charcoal dust, and then apply it on the wounded parts of the tree with a painter's brush, in the same way as painting, laying it on when the wood is dry, and in a dry day, so as it may dry before the rain washes it off. This may be repeated yearly, till the wound is healed up. When salt water can be got, the one half of salt will do for each gallon. By an early application of the above balsam on a wounded place of a tree, or even where a large trunk has been amputated, it will

* For the manner of extracting the liquid see the figure in the plate.

† Larger quantities may be made when required, but abide by the same proportions.

be found to draw the bark very speedily over it ; so much so that I have seen it the means of drawing the bark over a wound four inches in diameter in one season ; and it will be found completely to keep away vermin and insects from the wounded parts, and prevent the rot from spreading even where it was begun to make its ravages, and will prevent the sun, the rain, and the frost, from being injurious to the wounded parts, and will completely cure what is called canker bites of cattle, and all kinds of vermin, &c. in trees. I do not wish to be understood as to go the length of asserting, (with Mr. Lyon,) that, if trees are wholly deprived of their bark, this balsam, or any other composition whatever, will keep them alive, and make them grow ; but twenty-five years' experience has taught me, that the above composition or balsam will heal the wounds, facilitate the growth, and preserve the life of a tree better than any other thing that has been suggested by any author that I have had it in my power to consult ; and

those who try the aforesaid balsam will very soon experience its healing effects.

Mr. Lyon proposes the following query as to barking trees :—

“ *Query*, May not forest trees be peeled with advantage, especially the oak, whose bark is so valuable in manufacture, and whose wood, to the wealth and defence of the nation? but which last is lost, being cruelly cut down for the sake of his bark before he is fit for this service. I had no forest trees to practise upon; but I have as little doubt of the result, as I had of that of fruit-trees, which will be not only to preserve the oak till he is fit for ship-building, but likewise increase the quantity of both wood and bark; for both increase in proportion to the circumference of the tree. The annual layers of wood and bark are, we believe, *caeteris paribus*, equal in thickness. Therefore a tree of four feet circumference will make double the quantity of wood and bark in one year, with one of two feet circumference: but the

increase will be still greater ; for when the stricture of the bark is taken off, the tree grows faster.

“ Since I first published my observations on fruit-trees, I have been at some pains in examining the bark of the oak ; and find that the tanning principle resides in every part of the bark, when fresh, except the inmost, which is left for the support and growth of the tree. It is likewise to be observed, that the oak ruptures the bark, and attempts an exfoliation, very early by nature ; that these half exfoliated flakes lose all the tannin, and are good for nothing in the manufacture of leather ; so that, in peeling the oak, there is both a gain and saving.

“ I know an objection has been stated against peeling the oak, that the wood growing faster will be less hard and durable. We believe the reverse will be the case : for when the thick rigid bark is taken off, the sap will be more exposed to the influence of the atmosphere,—the agent which converts the sap

into wood. And it will be found, that if a tree is either peeled or barked, long before it is cut down, the wood will be specifically heavier, harder, and more compact, than when it is cut down with the bark on."

I agree with Mr. Lyon that by barking the oak, and indeed every kind of tree, growing, and allowing it to stand for one or two years after it is barked, the timber will be more durable and hardy than when it is cut down with the natural sap in it, and then barked: but Mr. Lyon must have been very little acquainted with the tanning principles in the oak bark, as the very reverse of what he states is the case, as the outer or corky part of the oak bark has not the least degree of astringency or tannin in it. Hence it often happens, when there is a great thickness of this outer bark on the trees, it is altogether rejected by the tanner, and has to be scraped off, and thrown away; and wherever there is any proportion of this bark, it is always bought at an inferior price, being of inferior quality.

SECTION XXXIV.

OF PREVENTION AND CURE OF DRY ROT IN ALL
KINDS OF TIMBER.

IN entering upon this most destructive malady, it will be found interesting to the reader to lay before him a copy of the following letters on the subject, which appeared in the *Stirling Journal* in 1821 and 1822, when the disease made its appearance in the timber of the New Church of Alloa, (then only two years old,) as also in many other houses.

LETTER I.

SIR,

A disease in wood, under that name (though scarcely applicable) and of the most

virulent nature, has made its appearance in Scotland only within the last few years ; but where this plague has shewn itself, its ravages have been no less extensive than hurried in its operations. As this disease is little known in regard to its cause, commencement, progress, or cure, I have thought of communicating its existence in our neighbourhood, through the medium of your paper, more with the hope of calling the attention of your readers to a minute investigation of the subject, than from my being able to narrate any thing new from my own observations. For some time past, its progress has been productive of considerable trouble and expense in several dwelling-houses here, where the ground-flooring of some of them has been three times removed, and several experimental antidotes resorted to, but as yet without any proof of a permanent cure. Lately some slight appearances of this malady were observed on the ground-floor of the elegant new church of Alloa, which created a

suspicion of its having begun there; and on raising some of the boards, sufficient proofs were found of its actual existence and infectious disposition. A meeting of the heritors has just been held, and the promptest measures, suggested by the architect of the church, Mr. Gillespie, entered into, to prevent its extension beyond the ground-floor.

I believe it has been sufficiently ascertained that the rudiments of the disease exist in the timber when brought home in logs, its development commencing often afterwards in house-flooring, in the appearance of a whitish powder scattered over the adjacent parts, and afterwards springing up in a mushroom-like excrescence; and when this goes on without any check, we have had ample proof in our neighbourhood of its having wasted a piece of ground-flooring in a very few months. Perhaps some ingenious correspondent, who has had an opportunity of attending to the progress of the dry rot, may favour the public, through the medium of your excellent

Journal, with the result of his experiments ; or some one may perhaps be able to solve the following queries connected with the subject :—Query 1st, Has it been sufficiently proved to exist in the log ? 2^d, Does any local peculiarity influence its commencement, and what is its most probable cause ? 3^d, Does it originate in any particular kind of wood exclusively ? 4th, Is every kind of wood subject to its infection ? 5th, Can any thing besides wood be infected by it, so as to be brought into a state of decay ? 6th, Can any substance, besides wood, act as a conductor of the contagion ? 7th, Would the disease go on in a continued progressive state, or does it occasionally stop at what surgeons call the *line of separation* ? 8th, Is the outline or boundary of its progress sufficiently defined ? 9th, Has any specific been found to arrest its progress, or is a radical cure, by the total removal of the parts, the only safe expedient ?

If the insertion of this shall be the means of setting on foot a more general investiga-

tion into the subject of the dry rot, and of arresting, in any degree, its baneful influence, my end in view shall have been fully accomplished. I am, &c.

(Signed) B. J.

Banks of Forth, 19th Sept. 1823.

LETTER II.

SIR,

Although a constant reader of your paper, from my occupation it sometimes happens that I cannot see it till it is at least ten days old. This occurred with your Journal of the 20th, in which is a letter, signed B. J. on "Dry Rot;"—a question in which the British nation is deeply interested, while it holds the first navy in the world, which has been, and may still be, the bulwark of this country. From the queries started by B. J. he seems to be a friend and well-wisher to his country, and as such only I would wish

to meet him. The subject, however, deserves to be taken up by some abler hand than mine ; but as I have, from my earliest days, been employed in rearing and working among trees and timber of every kind, and have paid much attention to the subject, experience, and a thirst for investigating their properties, has put me in possession of facts that are not generally known. I have studied trees from the nursery till they have arrived at maturity, I have also watched them in their decline ; yet I confess I am unable to answer the various queries started regarding dry rot, nor do I feel myself at present altogether at liberty to disclose every thing I know connected with this most destructive malady, in a public newspaper, and for this especial reason,—I am just now engaged in preparing a work for the press, in which the time of attack, the causes of the disease, and its progress, as well as the means for preventing it, will be particularly pointed out. But for the satisfaction of B. J. I shall en-

deavour so far to answer a few of his queries. Then, as to the 1st and 2^d, the disease commences often in the tree whilst growing, and also in the log. In answer to the 3^d, it originates in every kind of growing wood and cut timber. 4th, Every kind of wood is subject to its infection. 7th, The disease will stop only when the wood is completely destroyed. It can be prevented before the attack, but after having made some progress when the timber is made into work, it cannot be removed, but the infection may be stopped from spreading.

If B. J. will condescend to make himself known to me, and take the trouble to accompany me to a plantation, I will explain and point out to him, *as an individual*, a curiosity,—the disease in its commencement.

Trees, like men, have their infancy, their vigorous youth, their maturity, and their old age and decay, and at all those stages they are liable to particular diseases. The diseases of trees, when young, are often occa-

sioned by bad management, such as not attending properly to heal up such wounds and bruises as they may have received, or cutting off branches, and not paying proper attention to healing up the wounds so made ; but there is an infectious disease which attacks trees when growing, and when one tree is attacked with it, it often runs through a whole plantation, and this is the principal foundation of the dry rot ; and whenever a tree is seized with this disease, it should immediately be cut down. It is the same with logs lying in the timber-yard. One log, when seized with a disease, (which is often the case,) will affect all around it ; and such is the case if one joist or one deal in a floor is seized with the dry rot ; if means are not taken to stop its progress, it will infect its neighbour, and so on till the whole is infected. B. J. mentions the new church of Alloa as attacked with the dry rot already ; but I could mention a hundred houses, not much older than Alloa kirk, that have been finish-

ed with American timber, and are already in a complete state of decay.

If the ground-floor of the elegant church of Alloa had been laid with Scotch fir timber from the estates of Gask or Rannoch, in Perthshire, or from the north of Scotland, or with Larch fir, although only of forty years' growth, the floor would have stood for at least a century, without sustaining the slightest injury from dry rot. This should put builders of churches and good houses on their guard in the use of foreign timber.

I am, &c.

R. M.

Stirling, 2d Oct. 1821.

LETTER III.

SIR,

When any calamity threatens to affect the public at large, every individual is then called upon to render what assistance he can, in averting, or suppressing, the general evil; and when every individual becomes interest-

ed in the cause, and every one makes some exertion, however little, the general effort seldom fails in effecting its purpose.

It is, then, from an individual feeling of this kind that I have arranged my own passing observations, and collected some scattered remarks of others into something like an answer to the ingenious queries suggested, on the dry rot, by one of your correspondents, in a late number of your valuable Journal. Before attempting to answer any of the queries, I may remark, that I entirely concur with your correspondent, that the term dry rot is not altogether applicable to this disease in timber, as the fructification of the fungus, which is either the cause, or a consequence of the dry rot, is seldom without drops of water resembling tears, the Latin name *Lacrymans*, according to Sowerby, has been given to it. The dry rot is one of those evils supposed to be occasioned by a parasitical fungus of the genus *boletus*, sometimes called *ignarius*, I presume from the

circumstance, perhaps, of its having a shining or ignited appearance in the dark. This evil prevails most frequently in damp places, and has often an extremely elegant appearance, hanging in inverted cones, and other fantastical shapes. The sinuses vary from yellow to orange, or a bright red brown. The whole fructification often forms a circle from one to six inches in diameter, surrounded with an outer substance, tender and pithy, or cottony, of a pale brown. The upper part is commonly clothed with a white mucor. This pithy substance, without fructification, is often found by itself, and is very dry; whence it has received the name of *dry rot*. In answer, then, to your correspondent's queries,—

1st, Though I myself have not seen the dry rot, commenced in timber, nor cut out of the log, I have heard its existence there confidently asserted by some who have seen it. Another species of boletus, somewhat similar to that supposed to be the cause of the dry rot, is not uncommon on gates and posts ex-

posed to the weather ; but in such situations it does not spread much. I have also often remarked a species of the boletus in coal mines, where there was little ventilation and some damp, spreading to a considerable extent on the posts which were employed to support the roof, and these consisted of fir trees with the bark on, but very little decay could be noticed.

2d, Its cause by some has been ascribed to the extraction of the resinous principle from the wood, when in a growing state ; others suppose that it may be occasioned by the common practice of floating the timber newly cut, before any of the natural sap evaporates, and of cramming it into the heated hold of a ship, and bringing on some peculiar action, by which its power of resisting decomposition becomes lessened. It is well known that another kind of dry rot originates in timber being felled at improper seasons, or injudiciously prepared, in which case, instead of hardening into a compact texture,

being full of sap, which evaporates, the pores never close, and the whole soon becomes liable to internal decay.

Any local peculiarity influencing its commencement, may be reduced to these two causes, viz. the want of a free circulation of air, and to the presence of damp, a very small degree of which being sufficient to call it into action; as proof of which it is always found to commence either in the ground-floor of houses, or in garrets into which rain may have penetrated.

3d, Whether or not that species of *bole-tus*, which is supposed to give rise to the dry rot, originates in any particular kind of timber exclusively, I cannot, from my own observations, determine; however, from what I have seen, fir appears the most favourable nidus for its germination, in which decomposition, to a certain extent, must have begun, to favour the process, and we have every reason to believe that the rapid decay which takes place is greatly owing to some reaction

taking place between, and mutually affecting, these two agents.

4th, In whatever kind of timber the dry rot may have originated, daily observation confirms it as a fact, that a variety at least of other timbers are perfectly subjected to its contagion and ravages, and it has even been found that the rigid oak cannot hold out against its assailing power.

The disease has been known to creep up the feet of an oaken table standing on an infected fir flooring, and in the same way to ascend bed-posts, &c.

5th, I have heard it remarked, that a particular kind of soft slate was readily subjected to decay when long placed in immediate contact with infected timber ; but, as I could never trace this satisfactorily, I must leave its solution to those who may have had more ample opportunities of investigation.

6th, After the infected timber has been removed, the contiguous walls have frequently been known to retain and communicate the

infection, notwithstanding the application of lime, copperas, &c.

7th, I am afraid few of your readers will exactly comprehend your correspondent's (perhaps professional) phrase of *the line of separation*, which I believe signifies a line or visible boundary in the progress of mortification, though I confess I had recourse to my dictionary for my information. But, be that as it may, I much fear your correspondent will look long and look charily before he discovers any such line, if a supply of fresh timber is presented to the contagion, and placed under circumstances favourable to its being infected.

8th, The precise outline or boundary of this disease cannot be accurately ascertained.

9th, In this disease, as in those incident to animal life, prevention is much easier than cure. In fact there is no other cure for the part infected than excision, and the sooner it is done the better; as the disease spreads most rapidly when fungi are propagated,

throwing their minute fibres into the tubes of the contiguous sound timber, and producing that moisture which is a condition absolutely necessary for the putrefactive process." Many remedies as vague as the hypothetical reasoning to which they owe their conception have been forced upon the public, and these nostrums enforced with a warmth of recommendation equal only to their complete failure. However it is a subject of experiment alike interesting to the philosopher, the botanist, and chemist; and, as I have remarked before, still requires a general interest excited in this part of the country at least, to unravel its mysteries, and to let in the brightening ray of science on all its obscurities.

I have carefully subjected pieces of the bolletus to the action of the various acids, but the tardiness with which the strongest of them affects even the vegetable mass, promises little towards their ever being used with success as a remedy or corrective in the dry

rot: the strength of acid necessary in any wash that might be employed to destroy the fungus, would, I fear, prove destructive to the wood itself, which might render the remedy equally pernicious as the disease.

However, we know that vegetable as well as animal life is much affected by the atmosphere in which it is placed, and this would lead us to a natural deduction that some means might be resorted to, by employing gases destructive to the growth of the fungus. For instance, a process of fumigation with nitrous acid gas might be tried, which can be so easily prepared by pouring sulphuric acid upon nitre; and as the materials can be placed in almost any situation, the gas could be most effectually applied under ground flooring, roofs, &c. This process would require to be kept up for some days, which can be done on a very cheap scale, and without any risk of injury to the wood—the timber might even be impregnated with potash previous to the fumigation, by applying it in a

strong solution, and perhaps the subsequent formation of a salt might prove a check to the rot.

I have lately instituted a series of experiments on this interesting subject, but have to regret that my results are not yet so conclusive as to allow their being embodied. In taking leave of you for the present, I must apologize for the length of this article ; but I assure you it would not have appeared at all, unless from a hope that it might call forth a better reply to your correspondent's queries from an abler hand, or awaken in others an interest in the future prosecution of the subject.

I am, &c.

A CONSTANT READER.

A—, 2d Oct. 1821.

LETTER IV.

SIR,

From what appeared in your paper some time ago on the subject of dry rot, in

reference to the destruction which that pestilential disease has wrought in some of our goodliest edifices about Alloa, and as it has again made its appearance in a still more virulent degree, I have been induced to send you a few ideas which have occurred to me in ruminating on its nature and causes. Although much has been said and written on the subject, and although many have been the measures taken, either to secure against its attacks, or to abate its virulence, the disease is still unknown, and in its unwelcome visits has hitherto set precautions at defiance. Nor, Sir, do I now come forward to arrogate to myself the credit of having at last succeeded in discovering the *arcana* of its production and operations, but simply to throw out a few unconnected hints, which perhaps may be the means of guiding some person of greater and more successful research to the discovery of the important secret. The first appearance of this disease was in the house presently occupied by the Rev. Mr. Fraser ; and

about a year ago, after various attempts to check its progress without success, the infected timber of one of the rooms was completely removed, and replaced by well-seasoned Baltic timber, laid in clay; yet, notwithstanding these precautions, it has again lately exhibited itself in the same floor, under circumstances which betoken no amelioration. Nor is this all :—it has made its appearance also, and has wrought no small degree of mischief, in all the adjoining new buildings, with the exception of two of the villas to the westward of the lately erected parish church; nor have the stateliness and beauty of that edifice itself rendered it proof against its vexatious encroachments. Now, Sir, in attempting to investigate the origin of the evil, I would humbly propose, as my opinion, (an opinion which facts will serve to render at least plausible,) that it exists neither in the soil, according to some, nor in the timber, according to others, but in the mortar used in building. That the soil, in the

present case at least, has no influence at all, is, I conceive, sufficiently disproved by the fact, that the two houses hitherto untouched by the disease, are so much in the vicinity of those infected, that the possibility of a variation of soil cannot once be admitted ; and that as little blame can be attached to the timber, is evident from the fact, that the timber used in building both the infected and the uninfected houses, was not only of the same quality, but of the same cargo. Here, perhaps, I may be allowed to remark, in passing, that, in all the cases which have come under my observation, American timber appears to be less subject than any other to the inroads of this disease. To revert to the subject of mortar :—It is an accredited fact, that the lime used in building these two houses which have withstood the infection, has almost nothing of uncalcareous matter in its composition, compared with that which has been most commonly in use. It is also well known that the former is much more

rapidly slacked, and of consequence can be much sooner used than the ordinary lime; and I have no doubt, but to this circumstance, joined to that of its having comparatively no admixture of argillaceous matter, may be attributed the preservation of the timber from the influence of this mischievous disease. As the timber of Mr. Fraser's house, when last replaced, was laid in clay, as a *dernier resort*, which circumstance, instead of retarding, seems rather to have accelerated the progress of the distemper, and as the lime commonly in use contains considerable quantities of argillaceous earth or clay in its composition, may we not hence conclude, that there is something in the lime which has a tendency, if not to produce the disease already referred to, at least very much to favour its destructive ravages? And, on the contrary, from the facts already stated respecting the vicinity of the uninfected houses, and the sameness of the timber employed in *their* construction, may we not also

conclude, that it is to the comparatively small quantity of argillaceous matter in the lime used in building *them*, along with other of its peculiarities, that they owe their preservation from this ruinous malady? In coincidence with what has just been said respecting the influence of clay in producing or fostering the disease in question, it may be here observed, that the soil of London is chiefly of the argillaceous description, and no where do we find the rot so prevalent and so destructive. On the other hand, in Dunbar, where the lime of which I have been speaking is universally in use, I have the best authority for saying, that nothing like dry rot has ever made its appearance. And, Sir, in concluding these few hints, I consider it of importance to mention, that the lime used in building the two houses already alluded to as having withstood the infection, although in its immediate vicinity, was procured from the limestone quarries at Skateraw, on the

estate of Dirleton, and wrought by Mr. Brodie of Scoughall.—I am, &c.

S.

LETTER V.

SIR,

I PERCEIVE in your paper of the 8th inst. an ingenious letter from a correspondent signed “S.” on the subject of Dry Rot. It appears the writer entertains a notion that the disease is to be attributed to the qualities or nature of the mortar used in building: that the disease will appear in proportion as the lime used is free from “uncalcareous matter, joined to that of its having comparatively no admixture of argillaceous matter.” This I suppose to mean, that the mortar used is pure lime, and free from any clayey substance. The opinion is so widely at variance with my own knowledge, and with what may be daily observed of this pernicious disease, that the subject naturally

suggested to my mind a number of queries from which I beg leave to submit the following for your correspondent :—

1st, Is it argillaceous mortar, (which I suppose to be mostly clay,) or what else is it that causes dry rot in ships ?

2d, Is it clay, or what else, that occasions it in the flooring and joisting of houses, in the second or upper storeys ?

3d, Is it clay, or what else, that causes it to take hold of the log, before it comes into the hand of the sawyer ?

4th, Is it clay, or what else, that causes it to seize upon trees, while growing in the forests, and actually kills them ?

5th, Is it impossible that a vessel, containing timber, might not carry logs infected with the dry rot, and logs not infected with it ?

I shall mention one curious fact connected with this subject :—A few years ago, there was a fine looking brig built at Dundee, 140 tons register. She was built for sale, and for

that purpose was sent to London, where she lay for nine months. Not meeting with a purchaser, she was brought back to Dundee, where she lay for nearly four months more without a buyer. Her wearing and outside planks, below the bends, were American oak. As she did not meet with a market, her owners were going to put her to sea, and, on examining her, found the planks infected with the dry rot. They began to take them off, when they found all the planks to be affected, and even some of the timbers, which were of British oak, all which had to be renewed before she could be put to sea.

The superintendents of buildings in Glasgow and Greenock now watch the dry rot with the utmost vigilance, and, often before the buildings are finished, many of the joists, even of the upper flats, have to be replaced.

I am perfectly of opinion, Mr. Editor, that the dry rot exists in the timber, and that too in all kinds. I am also aware, and I

agree with Mr. S., that the disease, under some circumstances, and in some situations, may be hastened.—I am, &c.

R. M.

9th Dec. 1822.

My reason for inserting the letters here, two of them being from myself, viz. letters second and fifth, is, that when these were published, a great many questions originated from them. To answer all the queries put respecting this disease, or to sum up evidences of its direful effects on many a stately ship, as well as house, would be both a useless and uninstructional task; but to probe the wound to the bottom before applying the cure, we may consider a little its origin. That there is a disease to which timber is liable, most commonly known by the designation of dry rot, no one will deny; and from whatever causes it may originate, the great business is, if possible, to stop its destructive effects. This disease, then, often attacks trees when growing, and springs from

diseases in the roots, (see page 309,) diseases by insects, page 313, diseases by moss or damp, page 313, diseases by canker, external injuries, &c. page 314, all which, but particularly those by insects, (although imperceptible to the eye, like the mite in cheese,) lay a foundation for this disease ; and a cancer in the body, or a canker, (a better name for the disease than dry rot,) sooner or later destroys the whole log, unless measures be taken to prevent it. Trees cut down when very healthy, before coming to their prime or maturity, are subject to this disease ; which originates from the great quantity of sap-wood, which, if trees lie long in the log, always begins to mortify ; and this gangrene is always infectious, whether begun in a plantation, in a timber yard, in a timber or plank of a ship, or in the joist or floor of a house. Trees allowed to stand after they have arrived at full maturity, and begun to decay before being cut down, will also be subject to the disease. Trees that have remained healthy through-

out all their stages in rearing, that have arrived at maturity free from blemishes, that have been cut down when fully ripe, and all the sap-wood taken off them before being put into work, without receiving infection from a diseased neighbour, will only fail by the stress of wear or the ravages of time : therefore, properly speaking, trees, like any other growing vegetable or commodity, should never be used till they are fully ripe ; and when healthy throughout their course of life, cut down, the sap-wood taken off, properly seasoned before put into work, will be found most perfect and durable, without the assistance of any art to make them so. But as it would be altogether impossible to allow all trees to stand to be fully ripe, or to arrive at maturity, and as absurd to say that all trees cut down before arriving at maturity should be thrown away as unfit for use, we must therefore try to do by art what we cannot allow to be done by nature. Before entering upon the cure

of this virulent canker, (which, as I mentioned before, would be a better name for the disease than dry rot, but this being a common designation, I have all along confined myself to it,) I had a great many opinions on this subject, from different quarters, which I had prepared to insert ; but this volume having already far exceeded the bounds at first prescribed to it, I must omit them, as they would only bewilder and fatigue, and would by no means instruct the reader in any thing useful on the subject ; and my own opinion must also be condensed as much as possible. I must here, however, be allowed to observe, by the way, that all wood used for any particular purpose, should be well seasoned before being used : for this purpose all kinds of trees, without exception, should be stripped of their bark before being cut down ; and this should be done any time from the first of April to the end of August, and the trees allowed to stand till the month of October or November the year after, say

for twelve months at least after being barked, and immediately after being cut down, all the sap or white wood hewn off it. This may be said to be attended with a great deal of expense and trouble; but all trees to be used for any particular purpose should be dealt with in this way, and it will be found much more durable. At any rate, all kinds of trees of value should be cut down (if not stripped of their bark standing) in autumn, and immediately after squared up, by taking all the bark and sap-wood off, and exposing them to the air, keeping them from the sun, to preserve them from rending, till they are fully seasoned and fit for work. No tree whatever should be put into a piece of good work with the natural sap in it: by a careful selection of wholesome, sound timber, and properly seasoning and managing it before putting it into work, diseases may be greatly prevented.

But to come to the prevention and cure of the disease (*dry rot*) in timber, let the log, plank, or piece of timber, be dressed up, or

nearly so, to the purpose for which it is to be applied, and then put it into the steam-box or stove, (see the Plate with its explanation;) fill the boiler with the liquid extracted from oak timber, put in a quantity of lime shells betwixt the steam pipe and the end of the log, as represented in the figure, and steam it with the liquid for five or six hours; if a log or piece above a foot square, allow it to cool for four hours, and then put fire to the steam-stove below, and keep it burning till it is properly scorched and hardened by the fire, so as not to consume any of the corners of the log or piece of timber. As I said before, the timber should be made very near its shape and size, which can be very easily done in timbers for ship-building, or roofing, joisting and flooring of houses; as after it is fired, it will be exceedingly difficult to pierce with a tool. A difficulty arises here, as to the planks of vessels, as these must be applied to the ship's sides, from the steam, in order to make them bend; in

these cases they would require to be steamed a second time, after being burned, with the same material. This plan may be said to be attended with a vast deal of expense ; but this will not be so much as might at first view of the matter be imagined, as there will always be found about a ship-builder's yard as much refuse of oak timber as will keep a sufficient supply of the oak liquid ; and even when it is required to be bought in, plenty of it can be got for twopence halfpenny per gallon, and half a gallon will be found sufficient for every solid foot of timber ; and the expense of steaming it is a mere trifle compared with the benefits to be gained from it. For a more full explanation of this, see the plates and figures of dry rot.

But here, as I have ventured upon new ground, I shall be said to be more theoretical than practical, which I have all along studied to avoid. To give one or two instances of the trials I have made :—In 1816, near eight years ago, I made trial on a piece of Scotch

fir timber, that had lain amongst long grass with the bark on it, for four or five years, which had all begun to corrupt, and was steamed with the lime and the tree liquid; which piece of timber, I am well aware, would not otherwise have stood above another year or two at most, but it has now stood exposed to the weather for eight years. This was only done by the steam of the liquid and lime, without burning. I tried this also with a piece of round oak timber. This piece was cut off the end of a tree that was rapidly consuming with a rot, from the root end of it; which tree was about eighteen inches in diameter, and the piece cut off about three feet long. The rot in the end of the tree was hardly perceivable when the tree was cut, and in three years it had eaten or corrupted up the trunk of the tree for fully two feet, and more than one foot in diameter at the bottom, and was observed to make a degree of progress in extending its ravages every six weeks; and I have no doubt

would soon have gone through the whole tree, or log, which was eighteen feet long. I steamed this in the same manner as the fir piece. This was in 1818, now six years ago ; and since that time it has not made a single hair-breadth of more progress in the rot. It is here worthy of notice, that the remainder of the tree, or log, was used by Mr. Kewin, ship-builder, Dundee, in a ship, and has since had to be replaced, although, when the piece was cut off, there was not the slightest sign of the rot having reached above the cut. I have also taken the most open, porous kinds of timber, and steamed them in this way, and made them perfectly impervious. The liquid evidently contracts the pores of the timber, and it must be clear to a demonstration, that it will most effectually extirpate every insect that could be in the tree or log. I have also tried it with old planetree table tops, where the rot by worms was visibly making rapid progress ; which completely extirpated the worm, and stopped its ravages.

I must also observe, that I had not the proper means of trying those trees, and could only do it by closing them in a large boiler, which could by no means do them the same justice as if they had been in a proper stove. But when this succeeds in the imperfect manner in which I was enabled to make these trials, I have no doubt in asserting that it will be found, if properly attended to, to cure completely that disease in timber known by the name of dry rot, and must be of the greatest importance in ship-building, particularly when the means of doing it is so easy, and the expense so trifling; which, I must be allowed to say, is much more simple and cheap than any thing that has as yet been attempted. For a farther illustration of this, see the Explanation of the Plates.

SECTION XXXV.

DIFFERENT SOILS BEST CALCULATED FOR TREES.

THE nature and qualities of the different soils best adapted for growing and rearing woods, have before been, in some degree, taken notice of, and having already exceeded the bounds at first prescribed to this work, upon this I shall be very brief, the more so as it has been largely treated of by men far abler for the task. The best way of ascertaining with any degree of precision, and the only criterion to judge the soils by, is carefully to observe in what particular soils trees arrive most speedily and safely at maturity. I have observed that the oak grows fastest, and makes the best hearted timber, on strong good clay soils. Such is the case with the oaks mentioned on the estate of Alloa, in page 276. These trees, although very rapid

in growth, are most excellent timber. In a tree from two to three feet in diameter, there will not be above three quarters of an inch of white, or sap-wood; and in the very heart of the topmost branch there is little or no white wood. It is the same with the oaks on the estates of Airthrey and Alva, on the face of the Ochil Hills, and also at Inverary, in Argyleshire; but there the trees do not grow so fast. As was observed in the section on planting, the oak (which is fortunate for this country) will almost grow on any soil, as will also the Spanish chesnut, elm, ash, plane, and beech, which are the most valuable trees. The larch fir will grow in almost any soil, but will by no means come to be any thing like good timber or to maturity on freestone rocks. I have always observed, in all places of the country, where larch was cut from off a freestone bottom, that even at the age of twenty years it had begun to decay at the heart, and the decay proceeded from the

root. I have seen some larch trees cut from off freestone rock at the age of forty years, and the whole unsound at the root, and some of them rotten for eight feet up: I am therefore of opinion, that larch should never be planted on a freestone bottom, if intended for timber trees. The following letter from C. G. Stewart Menteath, Esq. of Closeburn Hall, in Dumfries-shire, confirms what I have seen, and know from experience to be true as to this.

“ Closeburn Hall, October 19th, 1821.

“ SIR,

“ When I had the pleasure of seeing you in Edinburgh, I mentioned to you some things relative to the soil most suited to the growth of the larch tree, which I had observed in a number of larch trees. I had occasion to cut down some of them of the age of fifty years and upwards. I was much surprised to find most of them somewhat decayed at the root, for some feet up the stem of the

tree, in some instances above six feet. These trees were almost all red wood. It seems to me to be a disease produced from the soil the tree grows upon, which I saw confirmed in a tour I made through Switzerland a few years ago. The lower country of Switzerland is generally freestone, and the sides of the lower mountains limestone : upon these soils I observed no larch trees growing, till I came to the mountains composed of primitive rocks, such as gneiss and slate rock, where I saw magnificent larch trees growing ; one of which I measured that had been blown up by the root, and had grown at the height of 6000 feet above the sea. It was sixteen feet in circumference at five feet from the root. From these observations I am led to think, that the natural soil for a larch tree is the slate rock, and upon freestone or limestone the larch will not be a long-lived tree. Indeed, upon the freestone gravel I find many of the larch trees at the age of twenty years

formed entirely of red wood, and in these trees the decay is commenced at the root.

I am,

SIR,

Your most obedient servant,

(Signed) C. G. STUART MENTEATH."

This letter, together with what has come under my own observation, convinces me that the hue and cry raised lately against the larch fir from the Duke of Athol's estate, and others throughout all the country, asserting that the larch fir is by no means a durable timber tree, and that proofs are already seen of its decay, is entirely owing to the use of trees of this kind that had begun to decay before they were cut down, owing to the soil they were reared and grew upon; and that trees of this kind should never be put into ships or good houses. But these trees are by no means any just criterion for trying the durability of the larch fir, as they carry along with them the diseases contracted in their

infant state from the soil, &c. and never can be durable, although the rotten parts should be all cut away. This is the sole reason of the cry raised of late against the durability of the larch, as the timber of those trees will not last like the timber of good healthy ones, without being steamed and fired, as directed for dry rot.

SECTION XXXVI.

MODE OF SALE OR LEASE OF NATURAL WOOD.

As so much difference of opinion almost constantly occurs at the sale of a natural coppice wood, it may not be deemed improper here to state precisely the articles by which it should be sold, relative to the manner of cutting and clearing the ground, &c. This

may be the more necessary, as the time may not be far distant when landed proprietors, having twenty-four yearly hags, or cuttings, may let them on a lease of twenty-four years, the same as a farm. This would be a most advantageous way for the wood-cutter, or bark-dealer, as he would then be yearly in the market, have always a command of the most experienced workers, have implements always at readiness on the ground for carrying on his work, and the most of his work confined to one estate. Great inconvenience arises from a person having a hag on one estate this year, and on another the next, and these, perhaps, 100 miles distant, and no cutting at all some years, and so on, which often happens; and, besides, he would have a most particular interest in attending to the rearing of his coming hags, to see that every inch of blank ground was filled up, and every attention paid to make them produce more bark and more timber. This would be no less advantageous for the proprietor, as the

tenant having such a particular interest in rearing his wood, he would be sure to get them in a good state at the end of the cuttings; and, of course, the next letting would bring a vast deal more annually; and his forester would only have to see that the tenant does his duty. Were I twenty years younger, I would have no objection to take a lease of 1000 acres of natural wood land, even in its worst state, and give the landlord a fair annual rent for his land, and at the end of twenty-four years be sure of making an independent fortune; at the same time greatly enriching and advancing the interest of the landlord.

ART. 1. The purchaser is hereby bound to cut all the barren or black wood of every description, the oak excepted, on or before the first of May next.

Art. 2. The purchaser shall be also bound to cut all the plants, or seedling trees, included in the sale, with a saw, two inches above the surface of the ground, and to dress the

stool with an adz, rounding it down from the centre, close to the surface of the ground; and on no pretence whatever shall he be allowed to peel off, or even to loosen in the smallest degree, any part of the bark below the cut of the adz; and if a stool that was formerly high cut, to be cut and dressed down to the surface of the ground, rounded in the top so as not to lodge water as directed in Sect. VII. and VIII. of this work. These stools are to be immediately dressed up after the trees or stems are cut; that is to say, of every tree or stem that is cut, the stool shall be dressed up the same day that it is cut, so that the young suckers, or saplings, may not be in the smallest degree impeded in their growths.

Art. 3. All the brush wood must immediately be removed off the top of the newly cut stools. All horses and cattle are expressly prohibited from going at large, or pasturing in the newly cut wood. And in removing the timber or bark, the carts are not to be allow-

ed to drive across, nor is the bark to be stacked on the top of any of the newly cut stools, unless it is to be removed on or before the 10th of July next.

Art. 4. Reserving from the said hag of wood to be cut, all seedlings, or young plants of every description, at and under four inches in circumference three feet from the ground ; as also, reserving such a number of oaks, ashes, &c. as standard trees ; (let it be here observed, that the trees to be reserved, besides the seedlings, must all be marked and numbered before the wood is exposed to sale;) which trees are all marked with a ring of paint, and numbered on the bark with a wood-iron, from No. 1. up to No. —. Nor shall the purchaser injure these reserve trees, or seedlings, in the slightest degree, with the felling or cutting of his trees.

Art. 5. The purchaser is hereby also bound and obliged to finish the cutting and barking of the whole lot or hag intended to be cut this season, on or before the 10th of July

next; and on no pretence whatever is he to be allowed to cut after that period. And he is to have all the cut stools properly dressed up for the growth, as aforesaid, the first lawful day after the cutting is finished, even though it should be finished before the 10th of July.

Art. 6. The purchaser is likewise hereby bound to have the whole of the wood and bark removed from without the newly cut hag, on or before the 2d of August next, and also cleared of all brush-wood. And he shall be allowed a piece of ground in a corner of the wood, or without the wood-gate, to stack whatever of the bark is remaining, and to lay down the remaining wood to block his spokes, &c. or otherwise to manufacture the timber. The newly cut hag is to be properly fenced in, and the wood-gate locked by the 3d of August.* The purchaser shall

* As the second, or Lammas growth, is the only growth that determines the future prosperity of a natural oak wood, the young shoots ought to be preserved with the greatest care

also be allowed such places, within or without the wood, to burn charcoal upon, as shall be pointed out to him by the proprietor's steward or forester.

These are the only articles by which a purchaser ought particularly to be bound. The others, as to times of payment, and the extent of penalty on a breach of any of them, and all to be performed to the satisfaction of the qualified person named for that purpose, can be made out according as the circumstances of the case may require. In the event of the hags being let on a lease of twenty-four years, the tenant ought to be bound to keep and rear the wood as in the

and attention, as they very often make most vigorous growth, and continue growing, if the frost does not become intense, till December, and often grow to the length of four, five, or six feet ; but this growth is very tender, and easily hurt. And when these growths are much disturbed, it often makes them come out from the stool in a horizontal manner, so as to run along the surface of the ground ; and ten to one if ever they can be brought to an upright position. This is one of the reasons why the greater part of our coppice woods are so scraggy, and crooked, and stunted in their growths.

manner laid down in the sections on cutting and rearing, &c. of natural coppice woods; and this must be particularly attended to. When the thinnings of old belts, groves, or standing plantations are sold growing, and to be cut down by the purchaser, the trees sold should be all properly numbered with a wood-iron; and every purchaser, when he cuts down his tree or trees, should be bound to put the same number on the root, or stool, that was on the tree before it was cut. This would save a great many disputes, both between the exposor and purchaser, and also between the purchasers themselves, which often happens when these thinnings are sold in small lots to different purchasers.

EXPLANATION OF PLATES.

PLATE I.

FIGURE 1. Surface-draining plough, see page 8, &c. This plough is intended to cut two furrows at once, and that chiefly on rough, uncultivated lands, so that every part of it should be somewhat stronger than the common plough. As the construction and make of the plough is now universally known, very little need be said upon it here. All that is necessary to say is, that the screw-bolt in the end of the beam, with the cross tree, is to be let up and down at pleasure, according to the deepness of the furrow; and the cross tree for the horses to draw by, so that they can go upon the land, or what is called the selion. The design of the chain from each end of the cross tree is to keep it more steady, and to take part of the strain or burden of the screw in the end of the beam, in the event of the horses not drawing equally. The first coulter is placed in the centre of the beam in the usual way, about six inches before the other two, and it cuts the centre or division of the two furrows; the other two coulters are placed opposite to each other, one at each side of the beam, fixed to the beam with a mortise of iron and screw bolts, with a knee or bend at the neck of each coulter, to make them cut the furrow to the breadth. The sock is fledged on both sides to cut and lift the furrow up to the earth-boards; which,

for lightness to the plough, should be of wood, nearly in the fashion of the old Scotch plough, with a piece of wood in the form of a wedge, on the upper side and back end, to throw the furrow completely out upon the land: in other respects it resembles the common plough; only, it is about three inches longer in the sheath, that is to say, deeper between the sole and the beam. If every part of the plough is truly constructed, (as it should always be,) it will require little more power to draw this than the common plough in ordinary land; but when there are many roots of heath, &c. and the ground very rough, it may require four horses. This plough will be found extremely useful in opening up, and cleaning out, open surface drains.

FIG. 2. Inside of a circular saw, see page 200, &c. Very little machinery is necessary in erecting one of these saws; and where there is a thrashing machine, driven either by water or horses, a power can be got to drive one saw, by taking off the axle from the drum, as it is called, of the thrashing machine, and putting on it a pulley or drum for a leather belt, which is put upon a small pulley on the axle of the saw, which generally gives a saw of two feet diameter both motion and power enough. I have often known the whole apparatus furnished and set a working in this way, by a borrowed power, for from seven to ten pounds; but, granting there was a wheel to make for the first power, the whole will not, in ordinary cases, cost above thirty pounds, as there is so little machinery required. A two feet circular saw requires to revolve about 700 times in a minute. Portable machinery of this kind is now in use, and is carried and set to work in woods, wherever there is water to drive it. In this case, a small water-wheel, about eight feet in diameter, and eighteen inches wide in the hem, where there is a fall of water, will be sufficient to drive one to good purpose, and save a great expense of carriage in cutting small wood. A small saw about twelve inches in diameter could be put into a frame, and driven by a man, which would be very useful in cutting up fire wood about a gentleman's place,

as two men in one day with this saw will cut up more fire-wood than two men with axes will do in a week.

FIG. 3. Coppice-thinning chisel, see pages 153 and 154. This is nearly the same as the pruning chisels in general use. It may be two and a half inches broad in the face, from three to four inches long, sharpened on one side, with a wooden handle of three feet long, and the circle into the handle sharpened on one side. In thinning the stools the chisel is put to the shoot to be cut away, exactly on the top of the stool, with the one hand, and with a mall smallet in the other, give it a stroke, so that it may cut off the shoot at once; and, by keeping it always sharp, it will be found to do this easily without the least injury to the remaining shoots or stool. The circles on the upper end are for cutting off the small twigs, that are intended to grow, close by the eye, by pulling them upwards. This will be found to thin the natural stools of oak far more safely and speedily than any thing yet in use.

PLATE II.

FIG. 4. Portable wooden paling. There is scarcely any landed proprietor but what has great quantities of the thinnings of young larch fir plantations, which, in many places, cannot be disposed of at any price. This fence or paling I mean to be constructed of small larch fir stobs; these, for black cattle, to be four feet and a half, and for a sheep inclosure, five feet and a half long, one inch and a half diameter at the top, and two inches diameter at the root end; two holes to admit a three-eighth inch screw bolt in each of them, the one hole within three inches of the top, and the other within four and a half inches of the top of the stob; these put together with screw-bolts three-eighths of an inch thick, at whatever distances the stobs re-

quire to be placed, according to the design of the fence. Suppose the distance between the stobs to be six inches, each of the bolts must have a shoulder to keep them at that distance; and the screw the length of the thickness of the stob, each of the bolts having a thumb-nut for the screw, with which bolts the paling is put together. The stobs should go about three or four inches into the ground, according as it is soft or firm; the paling to incline to one side, say about two inches of the plumb, and a spur stob put in at every ten or twelve yards; these also to be fixed by bolts, the stobs to be rounded in the top, so as not to lodge water, and the whole of the stobs painted with the lime balsam, (see page 322,) which can be made a blue or black colour, by mixing it with the black; the stobs to be all barked, made, and dry, before painted; the part of the stob that goes into the ground to get two coats of the paint, a little thicker than ordinary; a hole to be made in the ground with a piercer before putting in the stob, and the stob put in with a slight stroke, so as not to take off the paint. I mention the larch fir for neatness, but any other kind of wooden stobs will do. They may require a fresh coat of paint every four or five years. If this is properly attended to, a paling of this kind will last for at least sixty years, and the bolts for upwards of one hundred years. One great advantage of this paling is the facility with which it can be put up or removed from place to place, in dividing fields or coppice ground, when only required for one year in one place. Two men, after the stobs are prepared, will put up nearly half a mile in one day. I need not remind the reader, that, when any up-hill or turns are required, it is only needful to bore the holes in the stobs in a slanting manner. The facility of repair, too, is a great saving, as new stobs can be put in with the greatest ease and speed. Nor is this paling at all expensive even at first, as the price of the three-eighth bolts will not much exceed that of the common paling, railing, and nails. This paling may also be put together in parts, with bolts, or rods of six or eight feet long, and divide the stobs by forelocks through

the rods ; but this is not so neat or elegant a way as the double bolts, and they are very little more expensive. This paling is so simple and easily understood, that the figure itself is sufficient explanation, and when done with small larch fir stripped of its bark, which is more smooth than the workman's tool can make it, and nothing can be more neat. It is far superior in look to the iron fences now in use about a gentleman's pleasure grounds.

FIG. 5. Peeling larch fir trees growing. This is easily done by putting a pole with a fork on the upper end up to the top of the tree, and resting the other end on the ground ; having also a block or pulley at the top end, and a rope to come down, to which, by three folds of the rope, is fixed a piece of wood about eighteen inches broad, and two feet long, with a circular end, to keep it steady to the tree. This board or piece of wood may be in form of a horse saddle, with two holes through it, upon which a person can with ease sit with his legs through the holes and put himself up and down the tree with the end of the rope at pleasure, and take off the bark, which will be easily done with the common peeling iron. As the branches of the larch fir tree are generally firm at the top, in order to have the pole at an ordinary length, not to be over cumbersome, the person can go upon the firm branches above the pole to the top of the tree, and peel it down towards the pole. This will be found a very simple and easy method of peeling the larch fir or any tree speedily, after the person has had a little practice.

FIG. 6. Mid-ship floor timber, beam, or to cut up into planks, &c. ; from nine to thirteen inches of curve, and from fifteen to twenty-five feet long, and from ten to sixteen inches square.

FIG. 7. Rising floor timber, or breast hook ; from eighteen inches to two feet and a half of a curve, from twelve to twenty feet long, and to square from ten to eighteen inches.

FIG. 8. First futtock ; from eighteen inches to three feet of a curve, from ten to fourteen feet long, and to square from nine to twelve inches.

FIG. 9. Second futtock, or upright timber ; from one to two feet of curve, from seven to ten feet long, to square from eight to eleven inches.

FIG. 10. Peak or lower transam, approaching nearly to a square ; from six to nine feet long, to square from eleven to fourteen inches.

FIG. 11. A knee, which is square, for joining the beams, &c. to the ship's sides ; from six to nine feet long ; to square from eight to twelve inches.

FIG. 12. Plank timber, stern post, or main transam ; from twenty to forty feet long, from nine to eighteen inches square.

FIG. 13. Top timber, straight, except near the lower end, having a curve from eight to fourteen inches.

The above is calculated to suit merchant vessels from 200 to 400 tons burthen, British built. See pages 188, 189, 190, 191.

PLATE III.

FIG. 14. The transplanting machine, put up to a tree while standing to be removed. The root of the tree being re-opened, place two strong planks across, to put the wheels on ; then turn the pole up to the top of the tree, and fix it at the top, and make the axle firm by ropes to the tree. It may be necessary to put some straw or old rags betwixt the tree and the ropes, to keep them from hurting the bark of the tree. The tackle also being fixed to the top of the tree, put the end of the tackle fold round the roller of the winch or crane ; and, having fixed the winch or crane to the ground by a stob or otherwise, a man at each end of the winch will very easily bring over the tree. Here it will also be proper to have a hand rope to the top of the tree. And so soon as the tree is loosed at the roots, and inclines to come down, the winch must be removed to the other side ; and, having still the same rope at it, it must here be used

as a guide, to let the tree come easily down on the machine ; which can be very conveniently done without the least risk or injury to the tree.

FIG. 15. The portable winch or crane. This is a machine chiefly of cast iron, about three feet six inches high, constructed with two cheeks of cast iron, fixed together by four bolts of iron about one inch thick, and to run on four small cast iron wheels about four inches high, a roller about six inches in diameter, and a small iron axle with handles, with wheel and pinion, the wheel eighteen inches, and pinion four and one-half inches, which gives it a very considerable power : with double tackle, two men will have fully four horse power. As this winch costs very little money, it will be found very useful upon gentlemen's estates for many purposes, such as putting heavy logs of timber on carts or carriages, or removing large stones, &c.

PLATE IV.

FIG. 16. Manner of planting belts and stripes of plantation, for inclosing and shelter, for their manner of thinning out, so as to make the trees stand in a triangular form, &c. see pages from 67 to 71.

FIG. 17. The transplanting machine, with the tree going along the field. All that need be observed here is, that if the branches of the tree be found too long for the upright shaft at the end of the pole, they should be tied up a little with small ropes, to keep them from rubbing on the ground. It may here be proper to observe, that the tree on the machine must be drawn along by the root-end.

FIG. 18. The machine for transplanting trees. This machine consists of two wheels, which should be at least seven feet high, and of considerable strength. As it may be useful for many more purposes, they should also be at the least six inches broad

in the hem, so as not to sink into, or cut the field, in passing along. The axle should be fully as strong as that of a cart axle. This axle should have a bolster of wood on it, with a circle cut out in the middle of it, so as to keep the tree steady when it is upon it: the pole about six by four inches, the wheel at the end of the pole to work upon a swivel, such as a castor. Should the tree have very long branches extending sidewise, the perpendicular shaft at the end of the pole may be made longer. In this case it might be well to have a spare one of additional length: as it is fixed into the pole by bolts, it can very easily be put in and out. This machine will be found very useful for many purposes, such as removing timber in the log, &c. which is hung under the axle.

PLATE V.

EXPLANATION OF THE MEASURING MACHINE.

FIG. 19. A represents a bell on the end of the axle which the main wheel runs on. B is a steel spring, which is lifted by a pin in the hem of the large wheel, which causes it to strike the bell at every twelve inches, which will be distinctly heard from the top of the highest tree. C is the handle which works on the main axle, like scissors, one on each side of the large wheel; one of the connecting rods goes into it, and is fixed with a screw, making a swivel joint, and by screwing the nut firm, the wheel can be set to any position, and it will work equally well any way. D is a small hand in the circle of the triangle that points to the inches, or quarters of an inch, on the wheel, and tells what is more than the inch after the spring is struck. E is a spring that strikes at every inch. F is the ring of the large wheel, which is calculated to measure exactly two feet, and is divided

into feet and inches, and fourths of an inch, and is like saw teeth on the hem, and goes round the tree, and tells the circumference in feet and inches by the striking of the springs. G, the inside wheel, in which are twenty-four pins, lifts the spring E, which strikes at every inch. H is the triangle which runs also on the main axle, and rests on the basis of the tree, and slides along while the wheel goes round; and the springs being fixed to it, it gives the measurement in feet, inches, and fourths of an inch.

FIG. 20. The rods for working the measuring machine, with it at work, each rod three feet long and one inch in diameter, with connecting screws of brass on each end of them; so that as many as are required for any length or height can be easily screwed into each other. The other small rods for taking the length of the tree, as also of its branches, are only five-eighths of an inch in diameter; each rod is also three feet long, and goes together also with connecting screws of brass. The rods are painted black, and divided into feet and inches, with white letters, so that, when applied to the tree or any of its branches, the feet and inches can be distinctly read from the ground. By connecting any number of the rods together that may be required, and by applying them to the tree or branches, as shown in the plate, you can take the exact length of the main body of the tree, or any of its branches, in feet and inches, at sight; which is both a speedy, accurate, and simple way of measuring standing trees, as to their height, or length of measurable branches.

PLATE VI.

FIG. 21. The rods, taking the measurements and dimensions of the branches of a tree.

OF WORKING THE MEASURING MACHINE.

The method of measuring round timber trees is accurately described by Mr. Hoppus, in his excellent book of measurements, and as his is the standard and customary measurer, I would refer the reader to it in measuring unequal grown trees. After having taken the length of the tree in feet and inches, which length may be taken by the rods, as already described, the girth is most generally taken at half the length; which girth we may now proceed to take with the measuring wheel. This is easily done, by putting up the wheel (see Fig. 20.) with as many of the connecting rods together as will easily put it up to the height required; then, suppose there are no branches in the way, and having before made a mark on the bark of the tree with the small rods, which have in the end of the uppermost one, a small marking iron for that purpose. This mark is made where the girth is to be taken, and from where you are to take your departure with the wheel; which being done, press the wheel round the tree, following it, and keeping it as level as possible; which the wheel will in a great measure do of itself, by its having teeth like a saw in the hem of the wheel, unless carelessly attended to; and as the wheel goes round the tree, be sure to count the number of times the bell strikes, which strikes at every foot; and when you see you have not another twelve inches, or one foot, more to run, come back again to the place where you took your departure from, count the number of inches that it strikes over and above the last foot, and thus you will at once have the feet and inches that the tree is in circumference; of which take the fourth, and this gives you the side of the square. But when there are branches in the way of getting round the tree, you must have a spare handle for the machine, as C, about two feet, or two feet six inches in length; and by altering the swivel-joint at the top of the first rod to any position required, the person working the wheel by the rods can stand in

the same place, and put the wheel half way round the tree, if it is very large, turning the swivel-joint, and reversing the wheel, at the same time sending it round the other side of the tree, till it meet where it left off; and by counting the feet and inches, as above, and adding the two together, you will at once have the extreme girth of the tree; by taking the fourth of which girth, you have the side of the square: thus one person working the small rods, taking the lengths, and marking for the girths. When branches are to measure, or when branches are in the way of getting round the tree with the rods, the person with the small rods stands on the opposite side of the tree, and directs the person when to stop with the wheel. Thus, by a little practice in working the wheel, and paying attention to count the feet and inches as they strike, two men will measure growing or standing trees as accurately and as expeditiously as if the trees were lying on the ground. A very little practice in working the machine will soon convince any person. The wheel being about eight inches in diameter, it strikes two feet before it goes once round, at the same time striking at every foot. Although the tree should have some hollows in it, it will be found to take the girth as correctly as a line will do. In taking the girth of round trees, the girth should always be taken where the tree is most equal, and free from any swell or hollow places, taking the medium of the tree for the girth, as directed by Hoppus. Indeed, some trees, such as spruce fir, may be so loaded with branches, that it may be impossible to get the machine at all in amongst them to take the girth; but this is only likely to happen in a tree of that kind, and may not happen in one tree out of a thousand. If the tree is such that you can get in the machine to where you are to take the girth, and if you can see where you take your departure from, and make your stop at, you can be at no loss to take the exact girth; and, by a few days practice in measuring with this machine, it will be found to measure more speedily, and equally correctly, if not more so, than taking the girth with a line, as by a

line you have first to put it round the tree, then you double it, and apply it to a foot rule ; you then take the half for the side of the square, whereas this machine gives you the exact feet and inches from the top of the highest tree, without the help of any other rule. This machine will also be found very useful in taking the length of logs, but especially crooked timbers, as you can easily run it along the centre of the curve ; which is the fairest way of measuring crooked timber. It may also be applied with advantage to take the length of a large crooked limb of a standing tree, where there is one of the sides clear of small branches, by running it up the centre as already described.

PLATE VII.

FIG. 22. Coppice trees at fifteen years old.

FIG. 23. Coppice trees at twenty years old.

FIG. 24. Coppice trees at twenty-five years old.

FIG. 25. Coppice trees at thirty years old.

See the figures of these trees described in Sections VII. VIII. and XXVII. with the manner of cutting, thinning, and valuing, &c.

PLATE VIII.

FIG. 26 represents a fir tree, the branches of which have been allowed to rot off, and of course leaves a blemish in the tree.— See Section XXIII.

FIG. 27 represents an oak tree properly pruned ; and in order to make it grow crooked, the horizontal branch is kept on the main stem, and the perpendicular one loped off, and other-

wise pruned in the top, in order to make it grow more crooked.—See Section III.

FIG. 28 represents an oak tree, such as figure 2, and having been dealt with when young as figure 27, has become a fine crook, the horizontal branch having become so strong, and has such unevenness of curvature, as to work in with the main stem, and will answer almost any purpose about a vessel, and of course is the most valuable of all trees.—See also Section III.

FIG. 29. Method of layering. See this explained and described in the Section on Planting, from pages 46 to 61. All that is necessary to be said here, in the explaining of the figure, is, that all unnatural twigs or shoots that come off from the stem, laid down betwixt the shoots, to be reared for trees, should be cut off, unless when these may be required to be layered out to fill up corners sidewise ; and when this is required, the layer should have another year or two's nourishment from the main root before it be cut off. The figure itself at once shows the simple and easy manner of layering, which is a sufficient explanation.

PLATE IX.

FIG. 30. Boiler, &c. For extracting the liquid from the timber, this boiler must be of cast or malleable iron, and should be from five to seven feet long, three feet wide, and say four feet deep from the top of the arch, built with fire brick, &c. up to the top. The wood is split or round, not to be more than three inches square in thickness, and at any length, so as to go into the boiler, which is put into the boiler at the door ; and, when full, the boiler-door is properly secured to keep in the steam, then the fire is put to it in the furnace below, and the liquid comes off in the pipe above, which is condensed in what is commonly called a worm, in a stand filled with cold water, and empties its contents into a spout below into barrels, or any other vessel ; and thus the li-

quid is prepared. Observe the stand must always be supplied with cold water. This operation is extremely simple and easy. One English ton weight of any wood, or refuse of oak-wood, will make upwards of eighty gallons of the liquid, which is used for different purposes. See page 244. The wood, when taken out of the boiler, may be used as charcoal, or as fuel for the boiler. There is also a quantity of tar extracted, which may be useful in ship-building. A is the boiler, B the boiler-door at which to put in the wood, C the furnace-door, D the pipe, E the cold water stand, F the cold water spout, G the spout for taking the liquid into the stand or barrel.

PLATE X.

FIG. 31. Dry rot steam stove. From what has been already said in the section on dry rot, very little explanation is here required, as all ship-builders are well acquainted with a stove for steaming their planks, to make them bend : suffice it to say, that this stove must be of cast iron, and of such dimensions as to admit of the largest piece, or log of timber, in general used at their work ; and when smaller pieces are required, the stove may be filled with a number of them at once, which will do equally well. The door of the stove, where the logs are to be put in, may be lifted with a wheel and pinion in a frame for that purpose ; and for ease in pushing it along, there may be rollers of cast iron in the stove to run it on. Observe, that the fires in the furnaces below the stove must be kept going, till what of the liquid may have been thrown into the stove by the steaming is completely exhausted, and dried up into the timber of the logs or planks, &c. till it is scorched with the fire, as directed in the Section on the cure of the rot, &c. A is a cistern for supplying the boiler with the liquid, B the boiler, C the steam pipe, D door for putting in the lime shells. E the steam stove, F the

rollers in side of the steam stove, G furnace door for the boiler, H furnace doors for firing the timber in the steam stove.

PLATE XI.

FIG. 32. Dissection of Plate 10, the steam stove, &c. &c. with a species of a crooked or bent stove, which will be necessary for crooked timbers. The little or trifling expense attending the curing of timber in this way about a ship-building yard, will easily appear to every person, when he considers the large quantity of liquid extracted from a ton of timber fit for nothing but burning, of which there is always a great quantity about a ship-builder's work; and the trouble attending it will be nothing in comparison with the advantages gained by it. Wood-merchants too should have a stove of this kind in their yards; as no person intending to build a good house would ever scruple or grudge paying one penny or even twopence per foot more, to have his timber seasoned for him to last for centuries; and not to have the joisting of his houses to renew in a very few years. It may be said, and it is a fact admitted, that I have not lived, and never will live, to see this verified in its full extent; but I have lived to see it verified in putting a most effectual stop to the ravages of the rot; and from the trials I have lived to make, I can boldly aver it will most assuredly do it; and, as to its making all kinds of timber more durable, and to resist all kinds of damp, wet, air, and worm, there will, with every unprejudiced person, be but one opinion.

PLATE XII.

FIG. 33. Elm tree on the estate of Touch, Stirlingshire. My reason for giving a figure of this tree is, that it proves to demonstra-

tion the different crooks and shapes that by a timely attention to the growth of trees they could be brought to grow to; the crooked branch of this tree had evidently once been the main stem, but was kept down, I am told, by children swinging upon it when young. Hence it has, as will be seen by looking at the dimensions, been brought to form crooks nearly equal in largeness to the bole of the tree. This tree affords a very great natural curiosity to the eye of a lover of trees.

My introducing the three following Plates may, by some of my readers be counted presumptuous, as they will appear more of a private and local than of a public nature.

These engravings were prepared some years ago, partly at the request of some of the proprietors, and chiefly to satisfy my own curiosity; as many questions had been put to me, particularly as to the plane tree at Kippenross, when I was at a distance from it; as also it served to refute a false account of its dimensions which had gone abroad, in mistaking the feet and calling them yards. Allow me further to observe, that these Plates being previously prepared, there is no additional charge made on the book on their account.

PLATE XIII.

Five Scotch Fir Trees on the Estate of Airthrey, Perthshire. These trees, as will be seen by the engraving, stand on very little ground; and till a person reaches within a very few yards of them, they appear to be one tree. They are said to be of a very great age, yet are still healthy and thriving in 1824; they are of the same species of fir as those very large trees about Inverary Castle; they grow on very bare soil, and I am of opinion,

not far from limestone rock. About a year ago there was a small branch broke off one of them with the wind: although not much thicker than a paling stob, it was all red wood, in colour resembling laburnum, and nearly as hard, which is proof positive that there is no fir timber equal in quality to the old Scotch firs.

PLATE XIV.

Ash Tree on the Estate of Carnock, in Stirlingshire. This tree grows very near to the house; and, I believe, is nearly the largest in Scotland when measured at the smallest part of the trunk. It grows upon a dry light soil; and, although not at a great distance from carse clay land, I believe it is on freestone rock. It is very healthy in 1824, and a beautiful tree. I can find no account of its age.

PLATE XV.

Plane tree, on the estate of Kippenross, Perthshire. This is the largest plane tree in Scotland, and, if I be rightly informed, nearly the largest in Britain: it has begun to decay in the trunk, and some parts of the branches; but some years ago, the proprietor was at some considerable expense to preserve it, covering over the places with lead, &c. In summer 1823, it received some damage by a thunder storm, but is still healthy in the top, 1824. One great curiosity in this tree is, that one of the branches above the cleft girths is twenty-one feet, being three feet more than the trunk of the tree: this tree grows on dry field soil, above a hard freestone rock, to which there is no great deepness. When the present house of Kippenross was built, there was a quarry opened up within a few yards

of its roots, and the large stones were taken up out of the quarry by tackle fixed to one of the branches of this fine tree, which was by this usage broke off, and allowed to remain in its shattered state, as is seen in the engraving, till it was cut off and covered with lead, a few years ago, as already referred to. The Right Hon. the Earl of Marr has favoured me with the following anecdote as to its age. "Mr. John Stirling of Keir, who died in 1757, had made many inquiries of all the old people, from eighty to ninety years of age, which takes us back to the reign of Charles the II. near the Restoration; they uniformly declared that they have heard their fathers say, that they never remember any thing about it, but that it went by the name of the big tree of Kippenross."

It was once my intention to give a description of the most of the largest trees in Britain, but this would be more curious than edifying, and the volume has already far exceeded the bounds I had at first prescribed to it. I must, at present, decline it: at some future time I may resume the task, by giving, in a small volume, an engraving of the most remarkable trees in Britain, with anecdotes and descriptions of their size, soil, situation, &c. so as to serve as a pocket companion, which will both amuse and entertain the traveller as he passes the places where they grow, this subject being altogether inexhaustible.* And, to conclude, allow me, forester, to tell you that you have both an ancient and honourable trade; and, as trees far outstrip the life of man, if you do your profession justice, they will testify to your memory, and speak peace to your ashes after you are gone; if you do not, every forsaken twig will blast your fame. To some foresters I can say, "Well done good and faithful servants;" but to others I may say,

* *Not a tree,*

A plant, a leaf, a blossom, but contains
A folio volume—we may read, and read,
And read again, and still find something new;
Something to please and something to instruct
Even in the humble weed.

“ How long wilt thou sleep, O sluggard, when wilt thou awake out of thy sleep ? ” Always take delight in, and make your profession a pleasure, not a toil. Solomon was both an ancient and honourable king, and he delighted in, and wrote of, trees, from the lowest shrub to the tallest cedar. The ancient poets sung of trees : Virgil has the following exquisite lines :

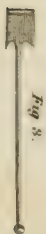
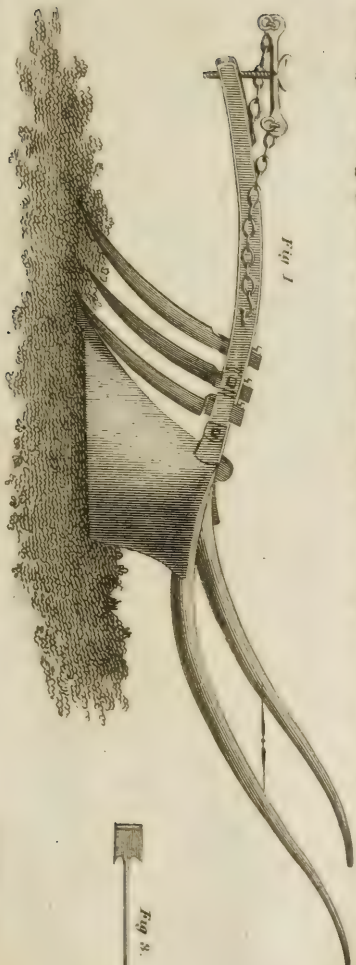
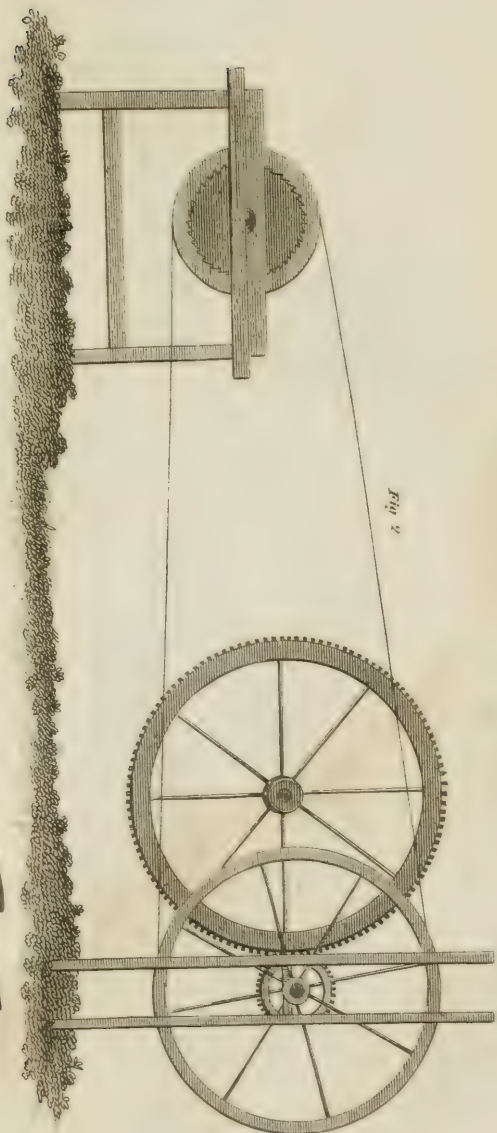
As o'er the aerial Alps, sublimely spread,
Some aged *Oak* uprears his reverend head,
This way and that the furious tempests blow,
To lay the monarch of the mountains low ;
Th' imperial plant, though nodding at the sound,
Though all his scattered honours strew the ground,
Safe in his strength, and seated on the rock,
In naked majesty defies the shock :
High as the head shoots tow'ring to the skies,
So deep the root in hell's foundation lies.

Where shall we find a match for Virgil's imperial monarch ? Must we scale the Alpine mountains ? No, but let us cast our eyes to the Highland mountains* and groves of Britain, and see her, in the following most beautiful lines, a match for all the world :

From a small acorn see the oak arise,
•Supremely tall, and tow'ring in the skies !
Queen of the groves, her stately head she rears,
Her bulk increasing with increasing years !
Now moves in pomp, majestic o'er the deep,
While in her womb Britannia's thunders sleep ;
With fame and conquest graces Albion's shore,
And guards the island where she grew before.

* There are many trees about Inverary Castle, the Seat of the Duke of Argyre, measuring upwards of 300 solid feet, and many oaks and Spanish chesnuts worth from L.60 to L.90 Sterling.

FINIS.



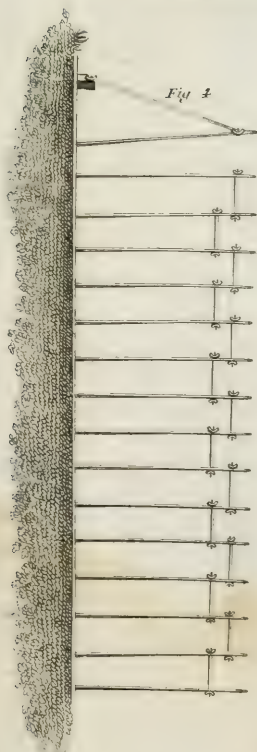
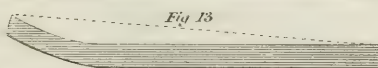
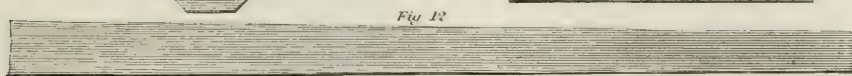
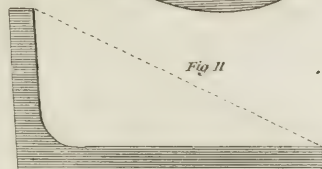
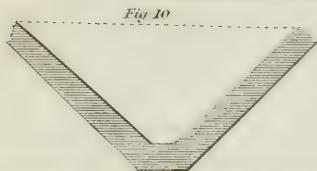
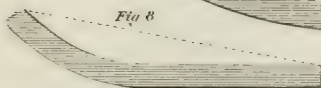
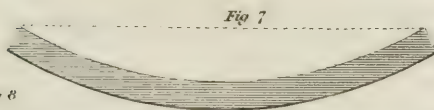


Fig 14



Fig 16

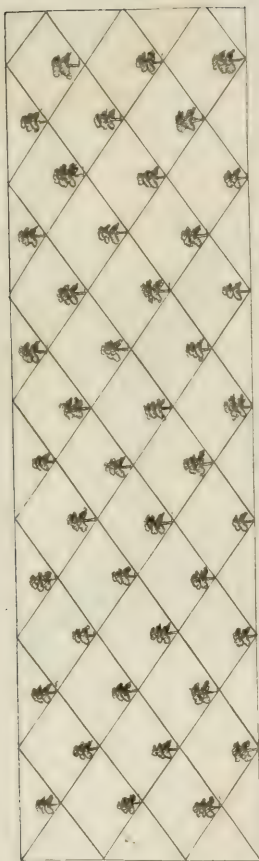


Fig 17

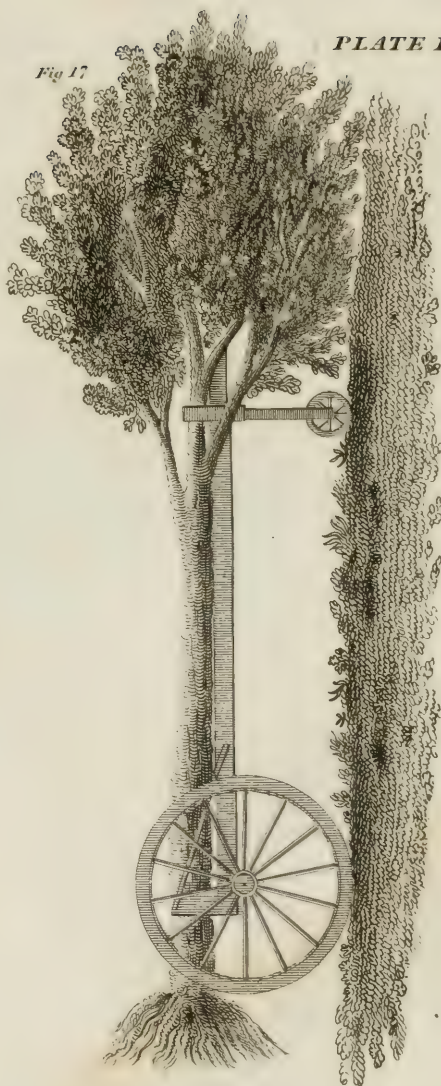
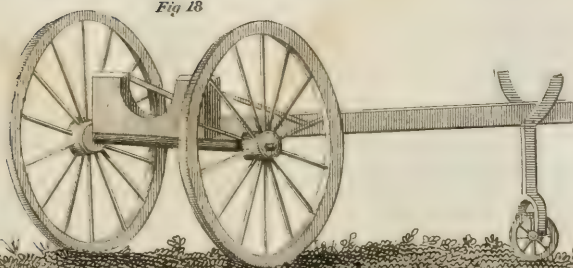


Fig 18



Drawn by J. Milne

Eng^d by T. Clerk



Monteaths Newly Invented Machine for Measuring Growing Trees.

Fig. 19.

PLATE V

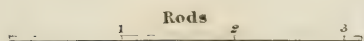
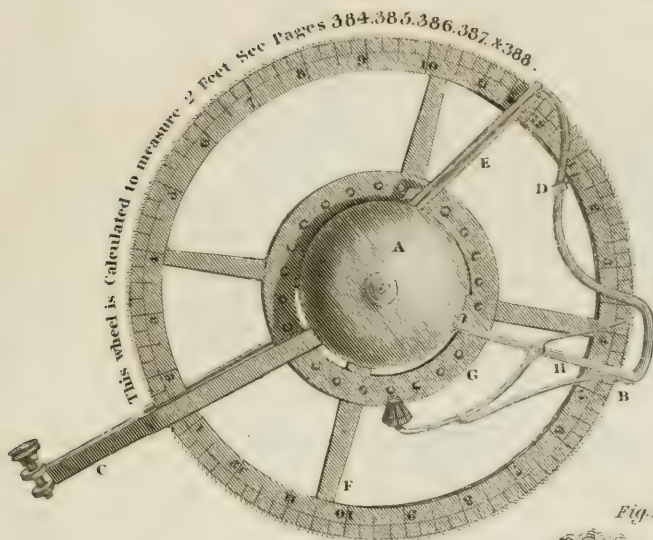
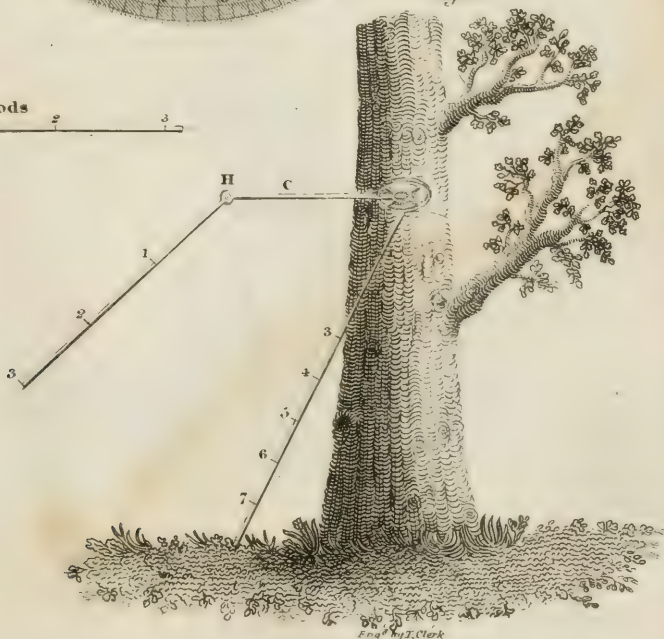


Fig. 20.

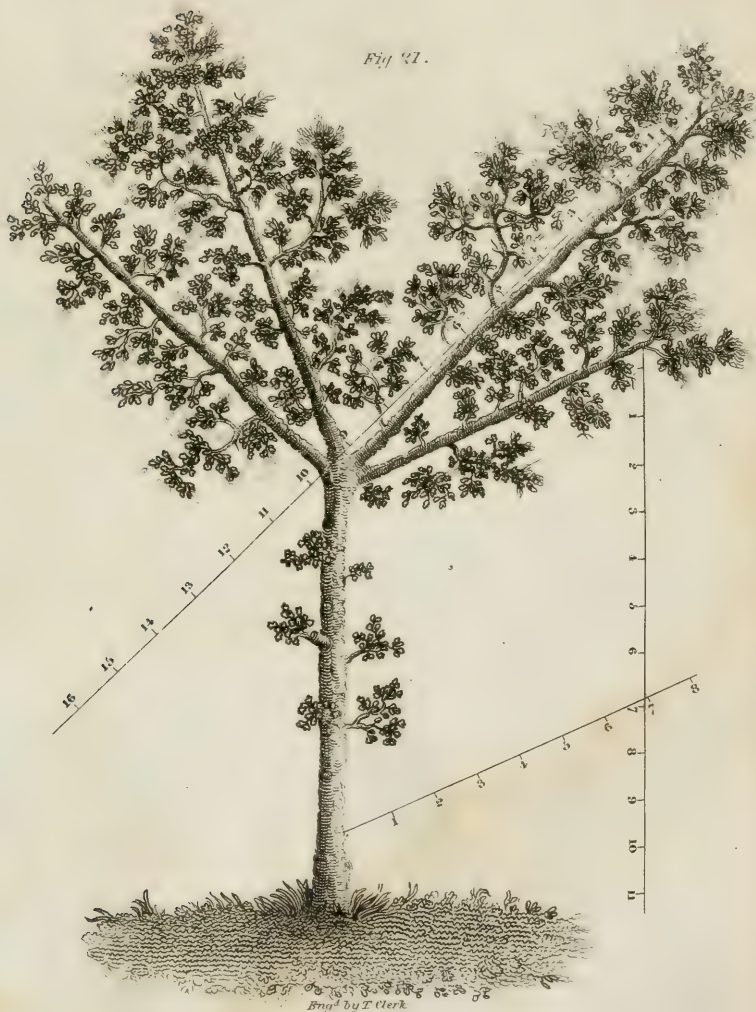


Monteaths CONNECTING RODS for

Measuring Growing Trees.

PLATE VI

Fig 21.



Published by Stirling & Keirney 1824.



Fig 26

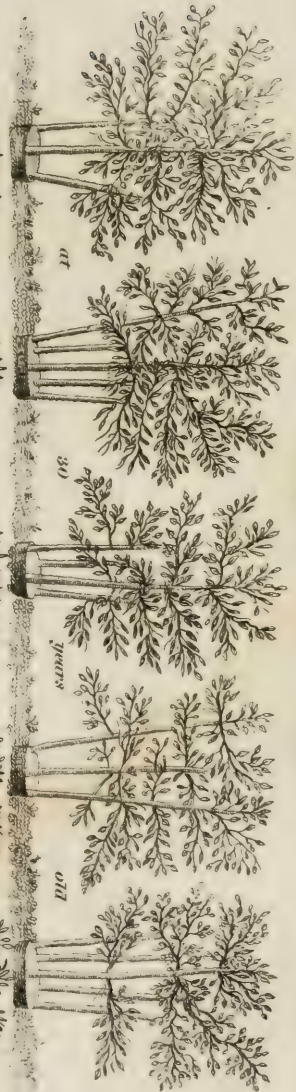


Fig 24

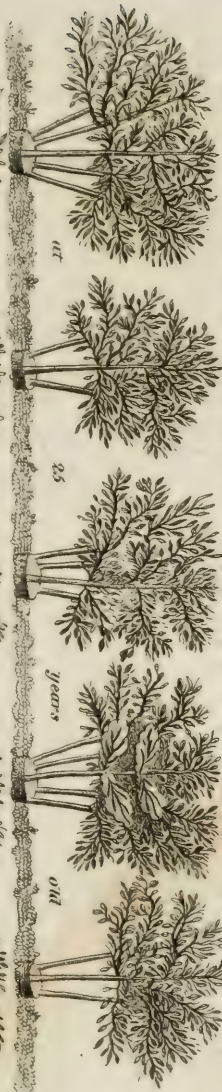


Fig 23



Fig 22



COPPICE TREES

Engr'd by T. Clout



Fig. 26

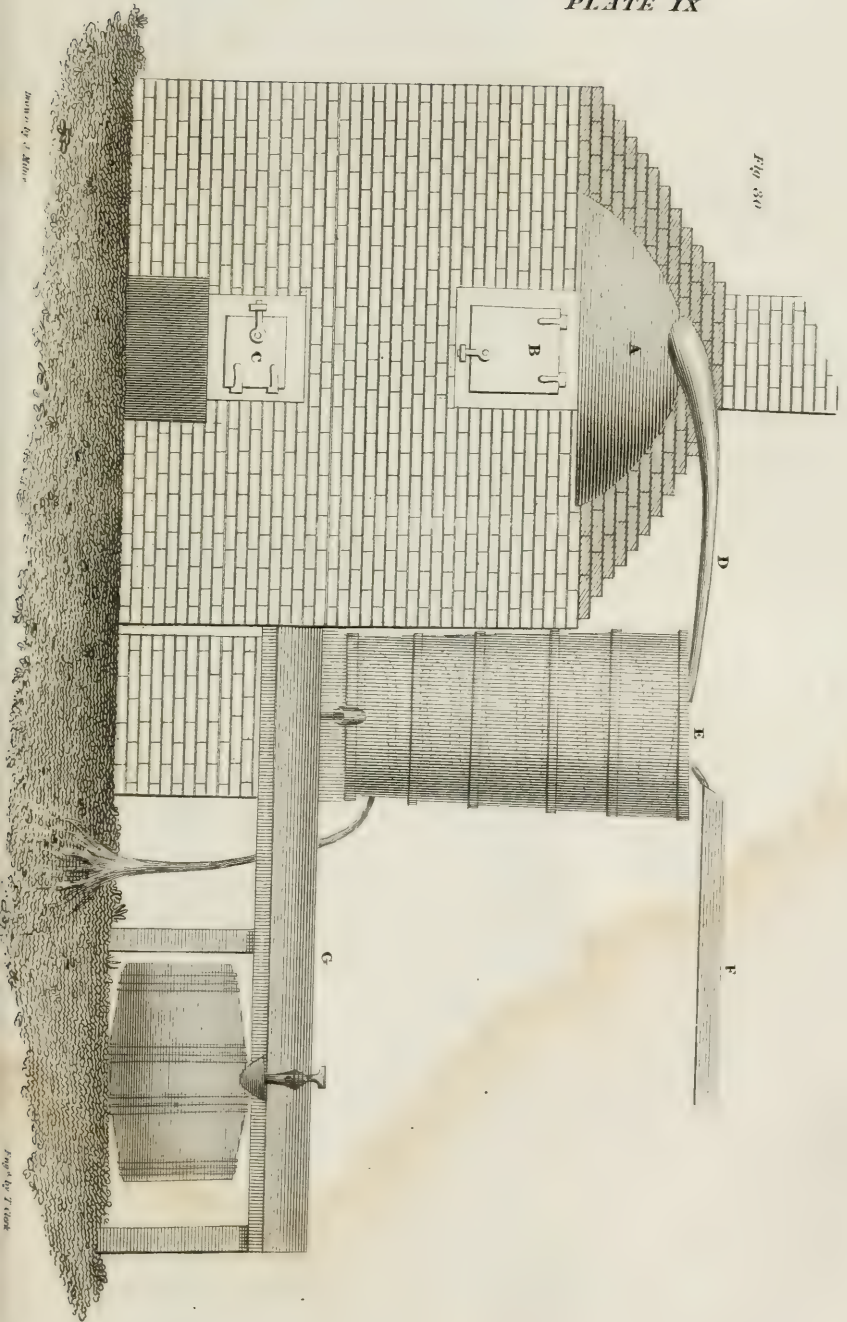
Fig. 27

Fig. 28

Fig. 29

Fig. 2

Fig. 30



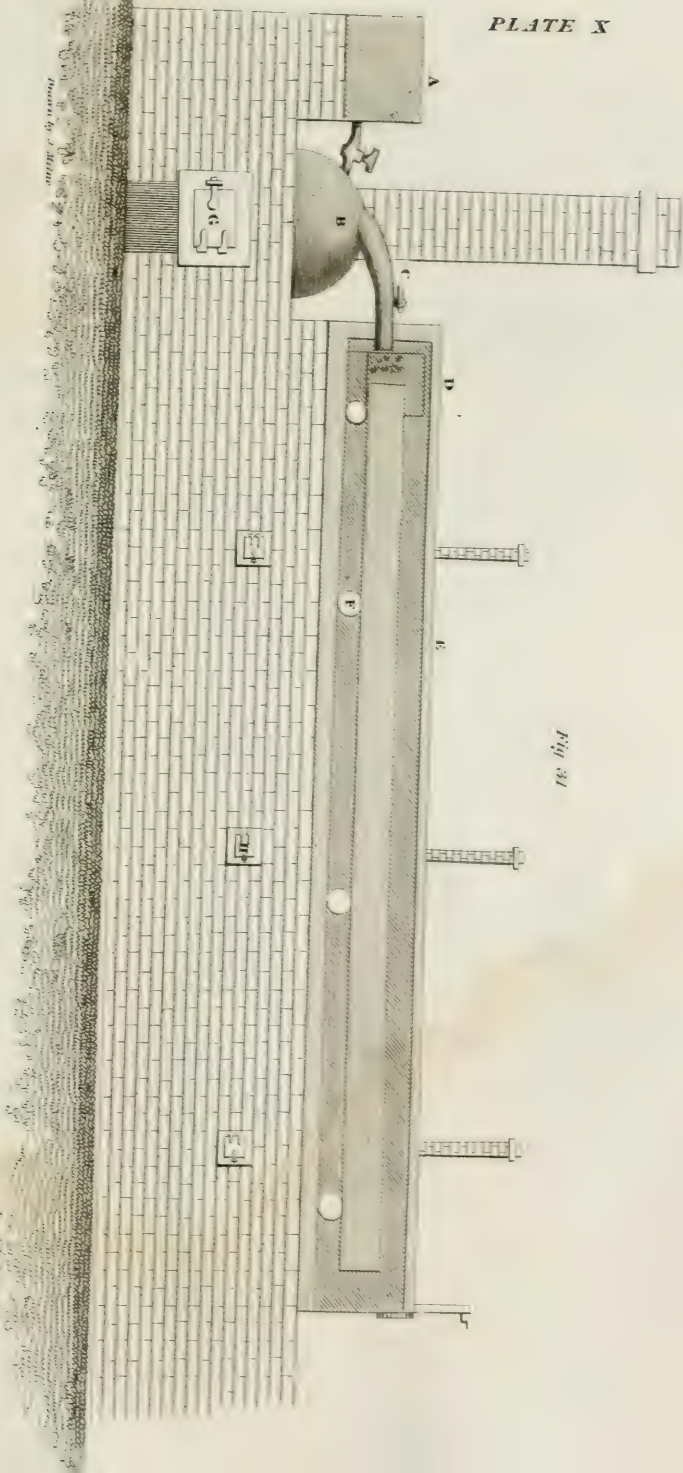
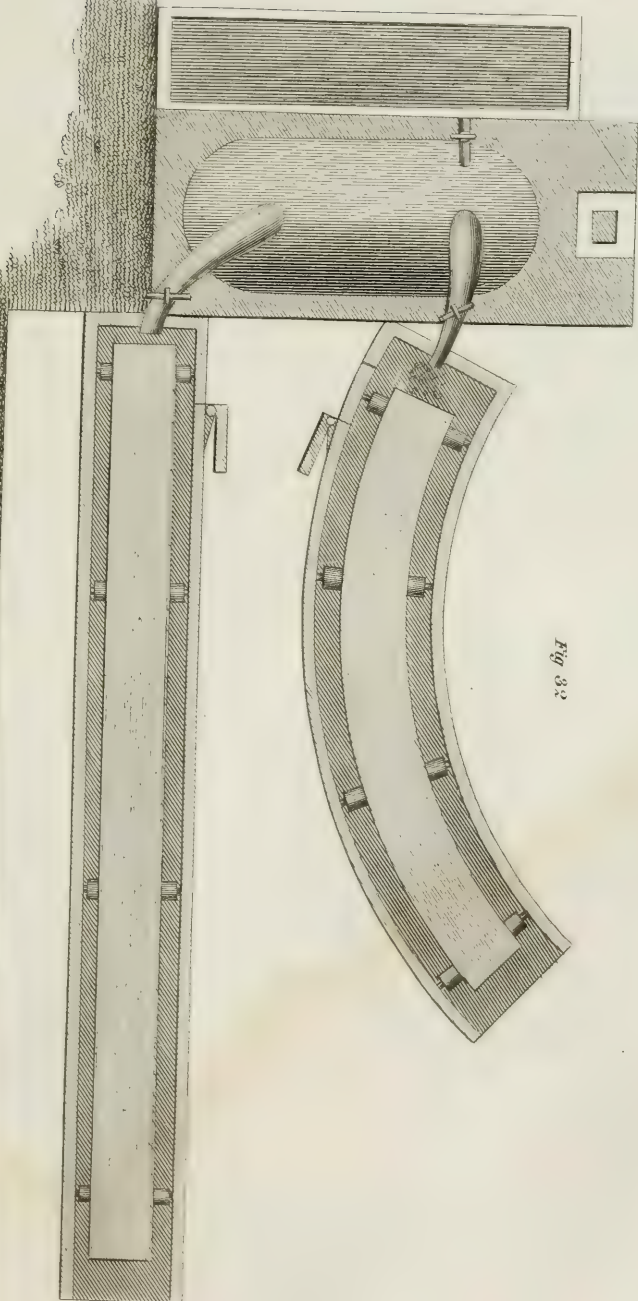


Fig. 31

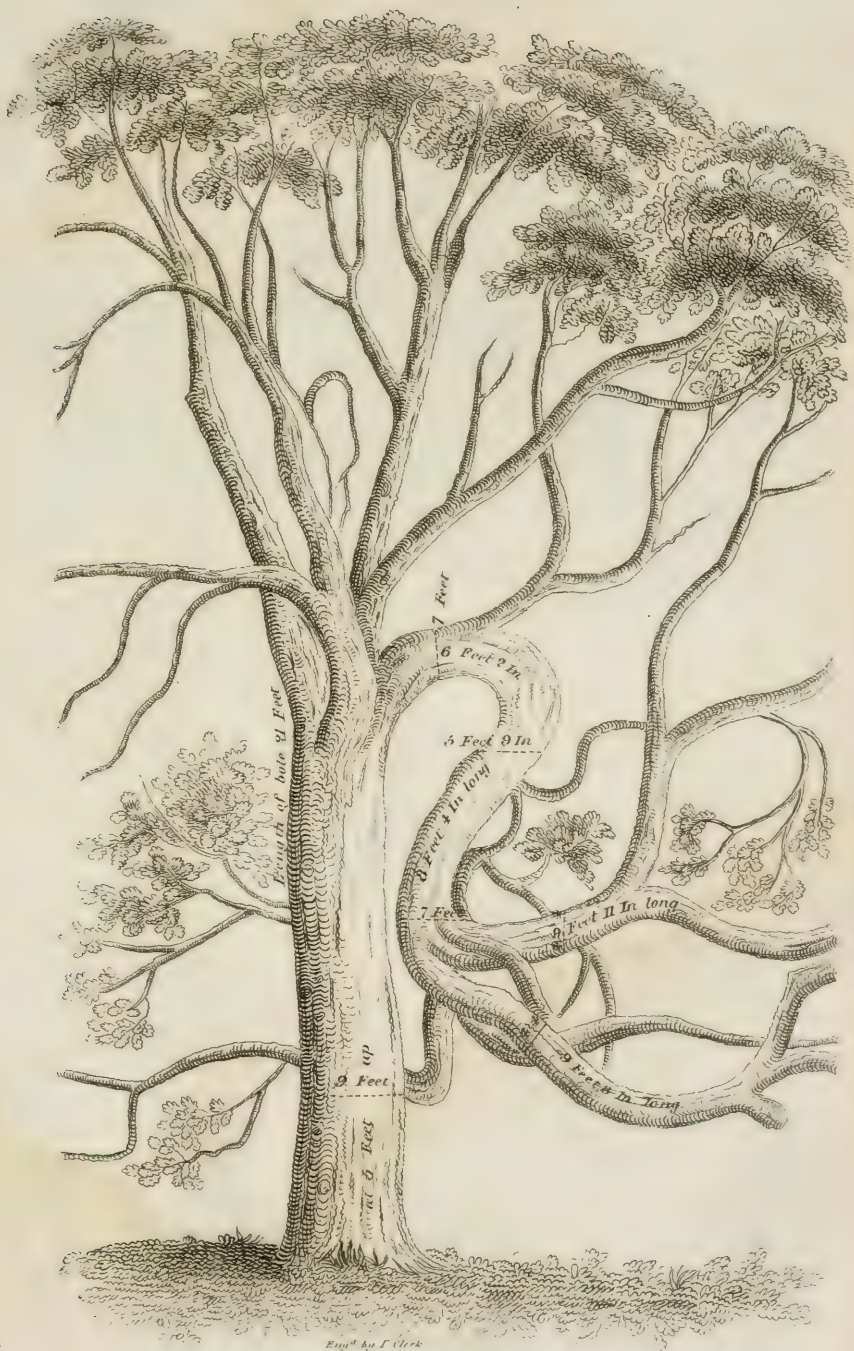
Fig 32



Drawn by J. Miller

Published by Scurry & Keursey 1824

Printed by T. Clark

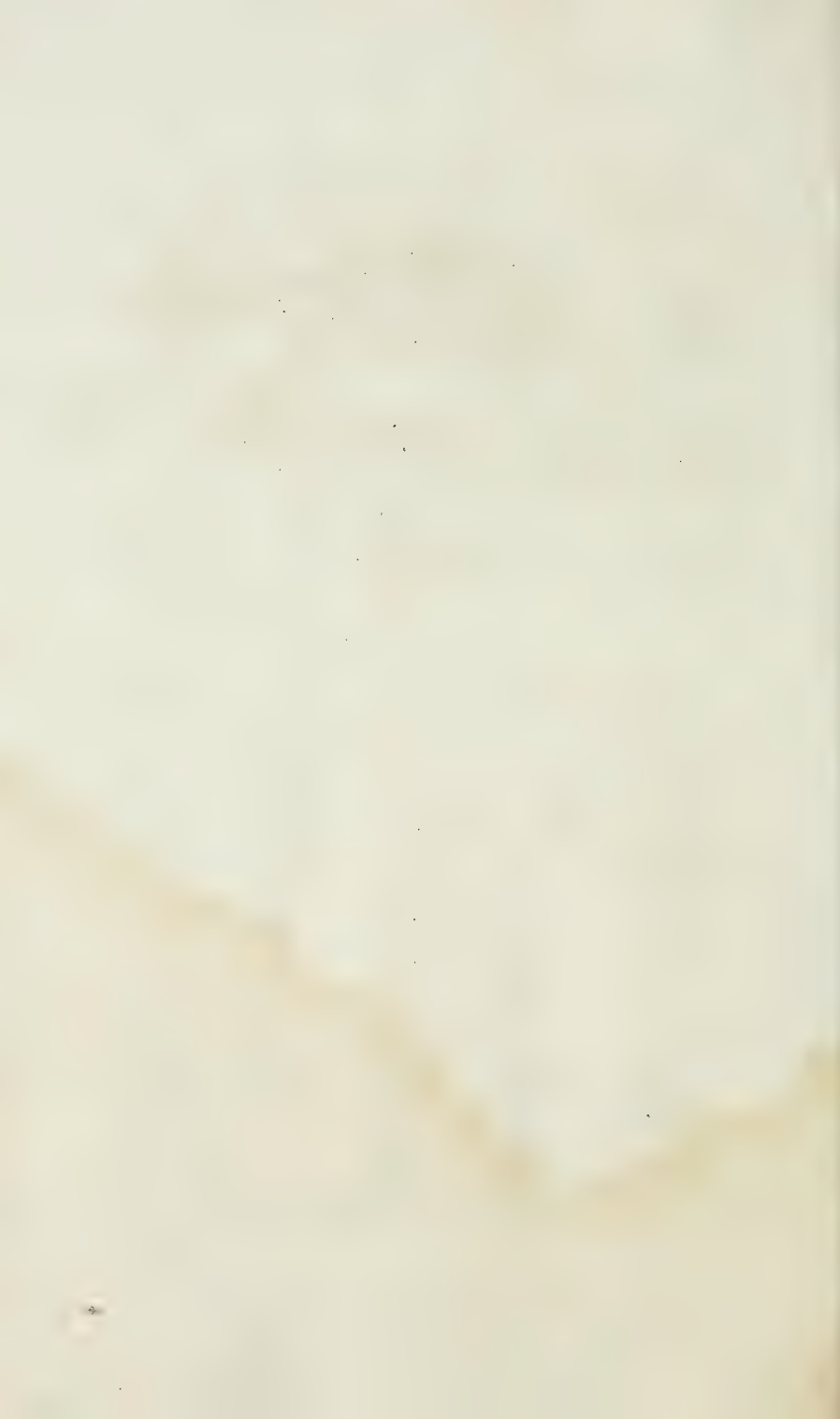


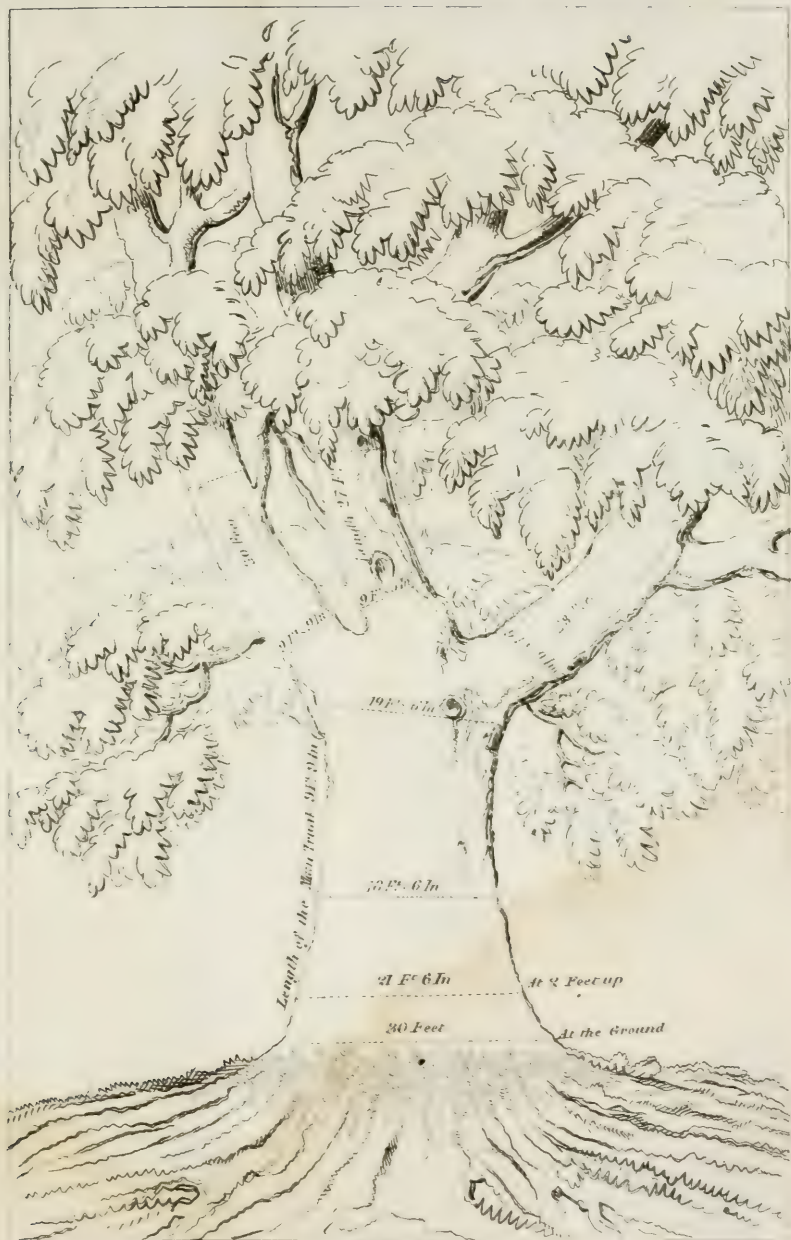
ELM on the Estate of TOUCH



FIVE SCOTCH FIR TREES ON THE ESTATE OF AIRTHREY.

The Property of Gen^l Sir Rob^t Abercromby K.C.B. measured 29th May 1821 the whole stands within 44 Feet 6 Inches of Ground in circumference.

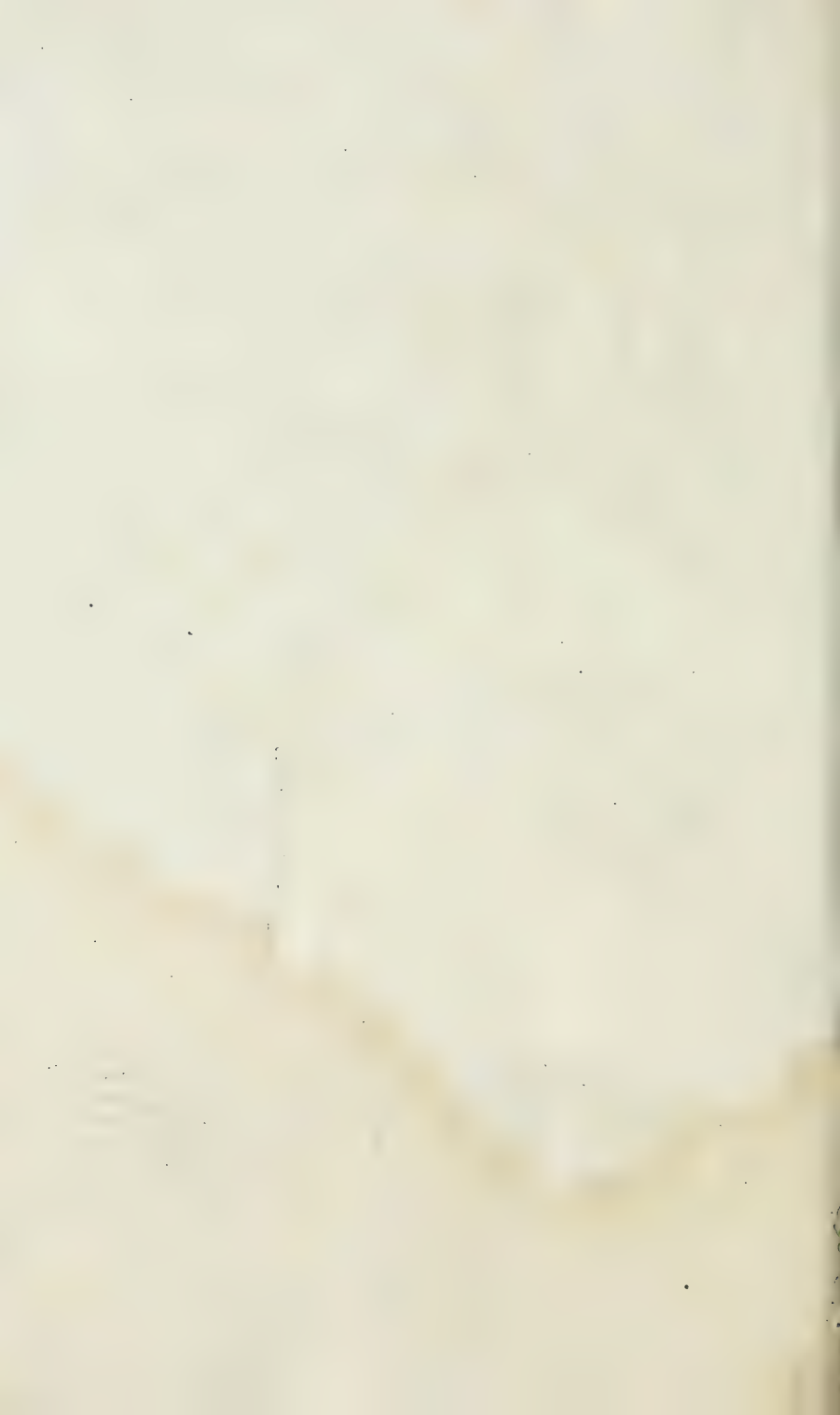


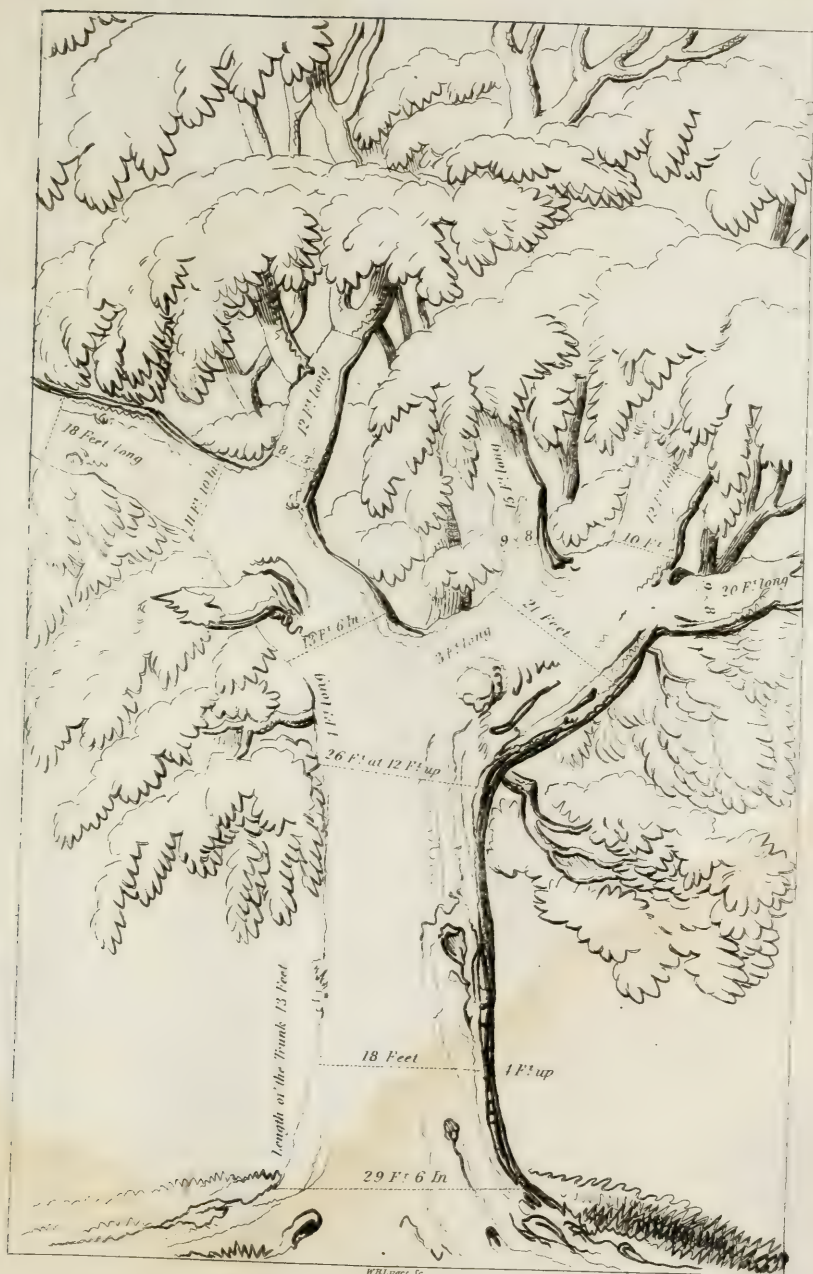


ASH TREE AT CARNOCK HOUSE STIRLING SHIRE
The Property of Mr. S. Neilson Esq. & contains 679 Cubic Feet

Measured with Moore's tree measuring Machine 20 May 1824

Published by Stirling & Kenney 1824





LARGE PLANETREE AT KIPPENROSS PERTH SHIRE.

The Property of John Stirling Esq^r measured the 29th May 1821 containing 875 Feet 2 Inches Cubic

The Circumference of Ground covered by its branches is 276 Feet

Published by Stirling & Kerney 1824



